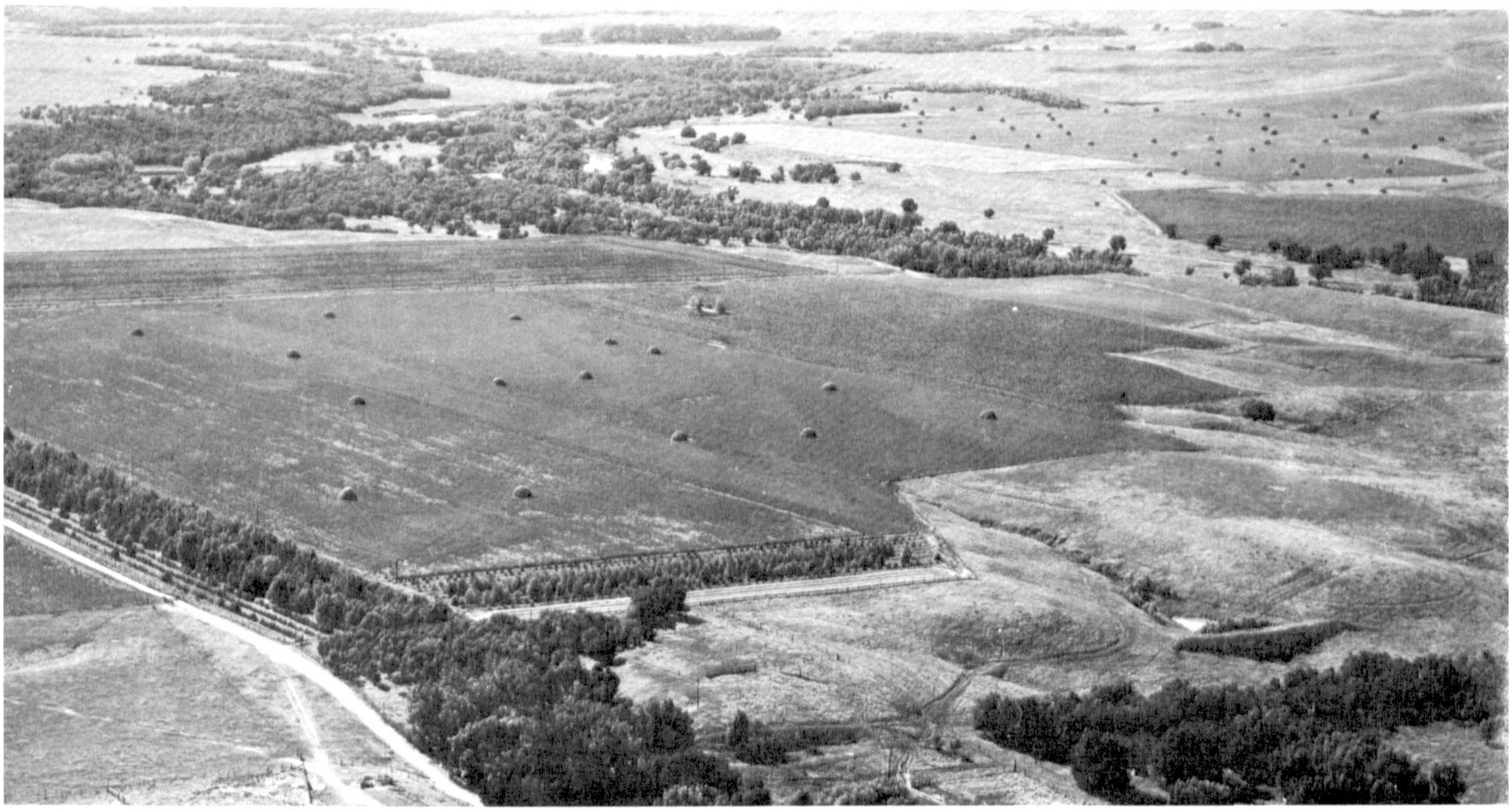
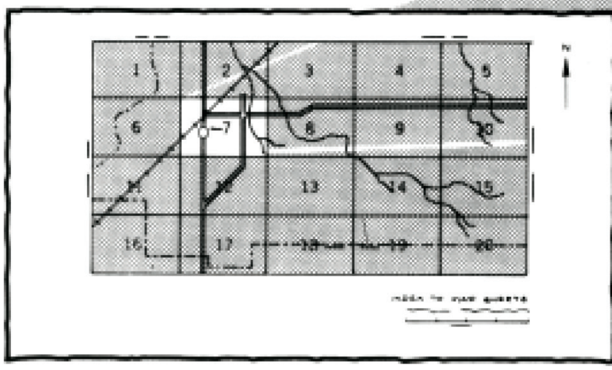


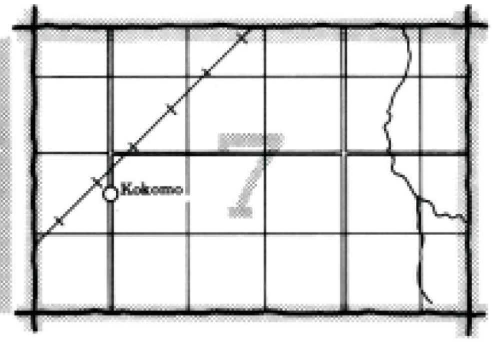
soil survey of Keya Paha County, Nebraska

United States Department of Agriculture
Soil Conservation Service
in cooperation with
University of Nebraska Conservation and Survey Division

HOW TO USE

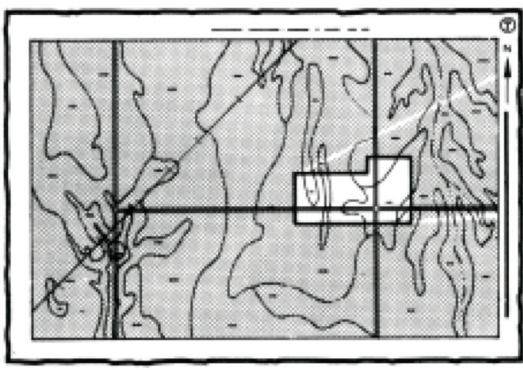
1. Locate your area of interest on the ''Index to Map Sheets''

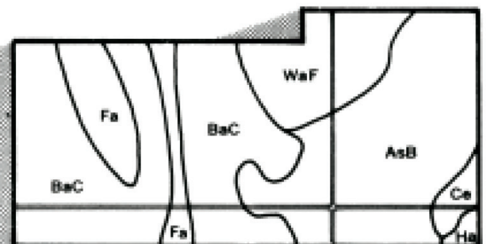




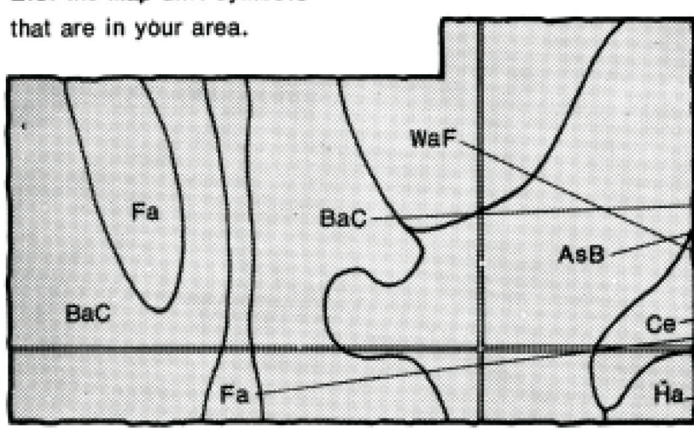
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.





4. List the map unit symbols that are in your area.



Symbols

AsB
BaC
Ce
Fa
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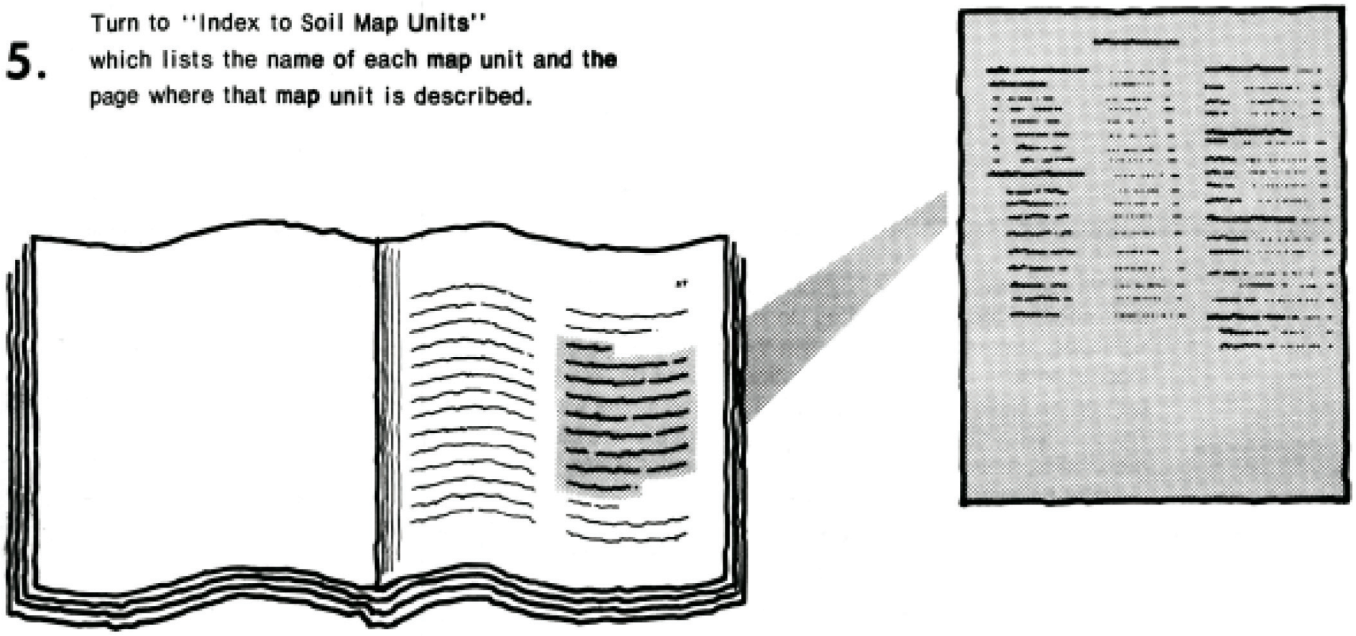
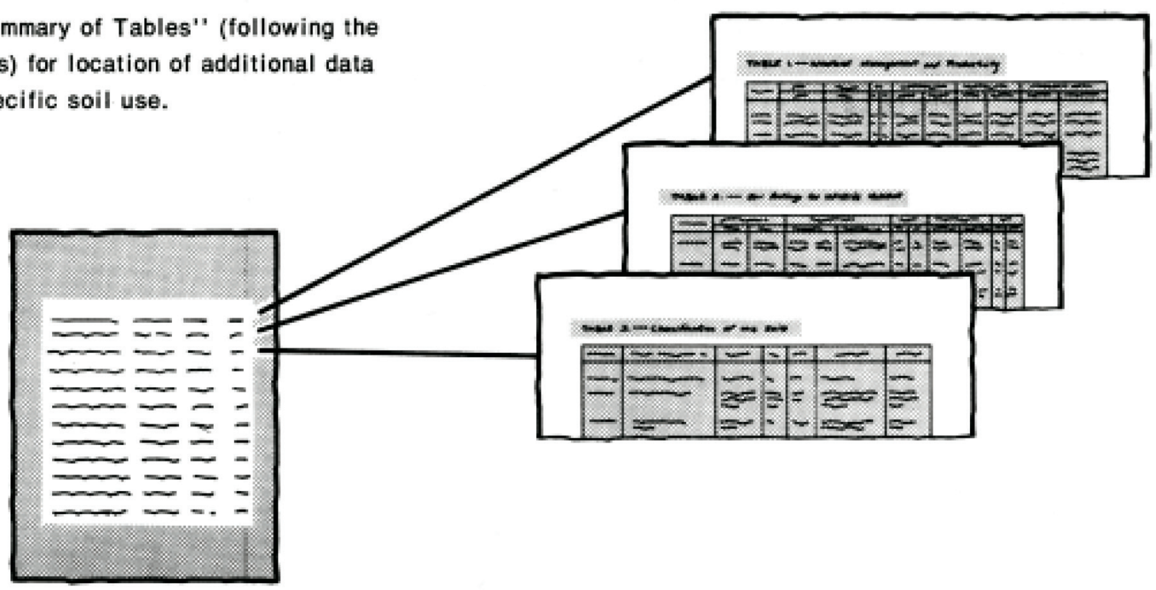
THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1969-1976. Soil names and descriptions were approved in 1977. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1977. This survey was made cooperatively by the Soil Conservation Service and the University of Nebraska Conservation and Survey Division. It is part of the technical assistance furnished to the Middle Niobrara and Lower Niobrara Natural Resource District. The Keya Paha Board of Commissioners provided money to pay for some of the aerial photography.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Conservation practices such as farmstead windbreaks, erosion-control structures, and farm ponds are used on this farmland in the Keya Paha River Valley. Soils in the Wewela-Valentine-Anselmo association are in the foreground, and soils in the Anselmo-Labu association are in the background.

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Issued October 1980

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foreword

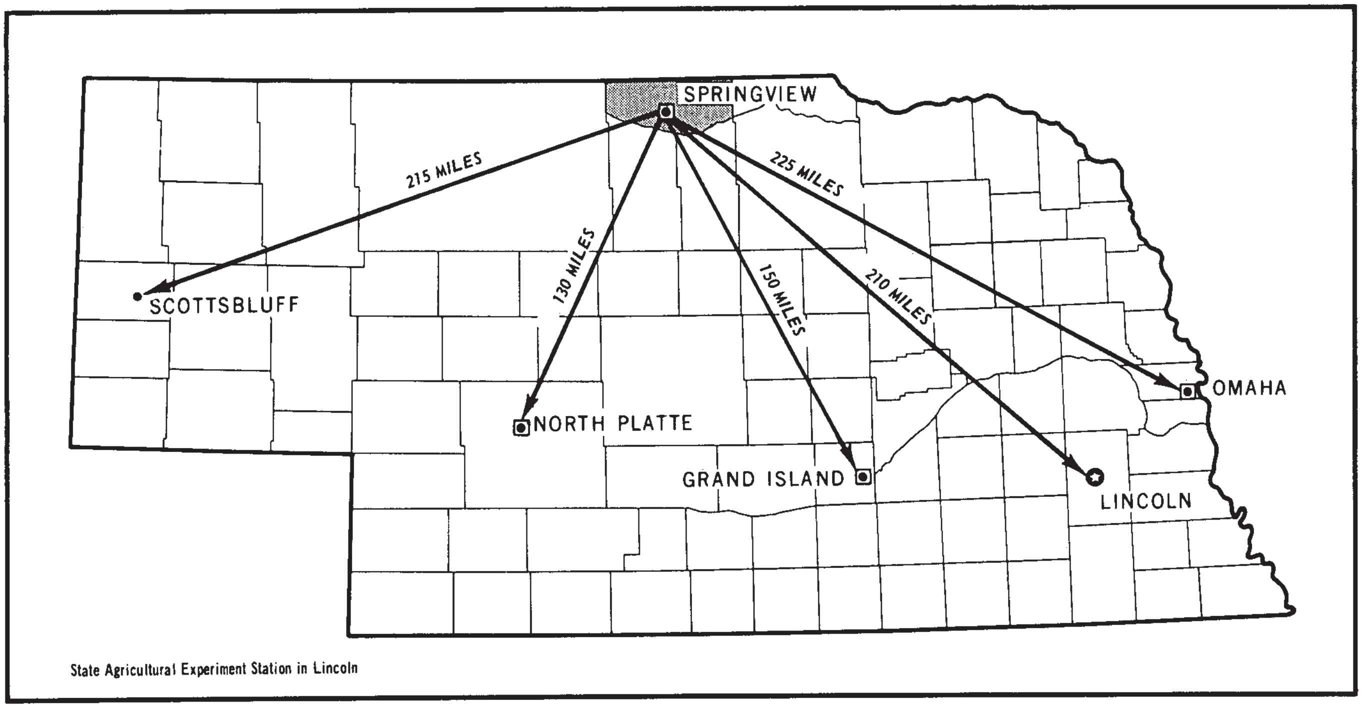
This soil survey contains information that can be used in land-planning programs in Keya Paha County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Benny Martin
State Conservationist
Soil Conservation Service



Location of Keya Paha County in Nebraska.

soil survey of
Keya Paha County, Nebraska

By Merritt Plantz and Richard Zink, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service
in cooperation with
University of Nebraska, Conservation and Survey Division

Keya Paha County is in the north-central part of Nebraska. It borders South Dakota to the north, Boyd County to the east, Rock and Brown Counties to the south, and Cherry County to the west. The total land area is 491,300 acres, or 768 square miles. Springview, the county seat, is the largest town. It has a population of about 260.

Ranching and farming are the main occupations in Keya Paha County. Ranching and related businesses provide most of the employment. Corn and alfalfa, the most extensively grown crops, provide feed for cattle as well as cash income.

Almost 90 percent of the soils in Keya Paha County are on uplands. The two major types of soils on uplands are the sandy soils that formed in eolian sand and the shallow, loamy soils that formed in limy sandstone. Other upland soils formed in weathered shale and in gravelly outwash material. Water erosion and soil blowing are the main hazards on the upland soils. Insufficient rainfall during some seasons is a limitation to crops. Conserving water on farmland and properly using the native rangeland are major concerns of management.

The remaining 10 percent of the soils in Keya Paha County are in wet valleys and on river bottoms. These soils formed in eolian and alluvial material. They are subirrigated by a seasonal high water table and produce much of the winter hay grown for livestock.

About 50 percent of the soils in Keya Paha County are sandy. Nearly 25 percent formed in material that weathered from sandstone. Some clayey soils are in the northeastern part of the county and on breaks to the Niobrara River. The soils in the survey area range from deep to shallow over mixed sand and gravel, bedded shale, and siltstone. They range from excessively drained to very poorly drained and from nearly level to very steep.

This soil survey supersedes the survey of Keya Paha County that was published in 1933 (*4*). It updates the earlier survey, provides additional information, and includes larger maps that show the soils in greater detail.

general nature of the survey area

This section provides general information about the history and development; physiography, relief, and drainage; geology and groundwater; and climate of Keya Paha County.

history and development

The first permanent settlements in the area that is now Keya Paha County were established in 1871 near the mouth of Wyman Creek. The early settlers came mainly from eastern and southeastern Nebraska and were of northern European, mainly German, descent. In 1884, this area was organized as part of Brown County. In 1885, Keya Paha County was separated from Brown County, and the county seat was established at Springview.

According to the federal Census, the population of Keya Paha County was 3,920 in 1890, 3,203 in 1930, and 1,340 in 1970. The villages of Burton, Brocksburg, Mills, Meadville, Jamison, and Norden have a population of 100 or less.

Keya Paha County has three major highways: U.S. Highway 183 and State Highway 137, which run from north to south, and State Highway 12, which runs from

east to west. These are all-weather, hard-surface highways.

In 1871, the agriculture in Keya Paha County consisted almost entirely of cattle raising. By 1885, farmers had taken over most of the better farming land under the Homestead and Timber Culture Act. Much of the land in the county is poorly suited to cultivation, and cattle raising has remained the main source of revenue.

In 1935, the federal Census reported that there were 571 farms in the county averaging 825 acres in size. In 1974, the Census reported 258 farms averaging 1,850 acres in size.

In the late 1960's and early 1970's, irrigation increased greatly because of higher grain prices, the introduction of the "center pivot" automatic sprinkler system, and the development of better well-drilling equipment. About 3,200 acres were irrigated in 1969, 7,400 acres in 1974, and about 15,000 acres in 1977.

The main crops grown under dryfarmed or irrigation management are corn and alfalfa. The acres of corn harvested for grain increased from 4,800 in 1969 to 7,200 in 1974. The acreage in alfalfa grown for hay also has increased in recent years. These changes in land use have resulted in the development of a cash-grain farming industry.

The total number of cattle in the county has increased from 31,000 in 1930 to 47,200 in 1974. The number of hogs has decreased from 16,000 in 1930 to about 6,000 in 1974. The number of poultry and sheep also has decreased in recent years.

physiography, relief, and drainage

Keya Paha County is in the High Plains section of the Great Plains physiographic province. There are six general landform areas that constitute the present topography and relief of the county. These landforms are the remnants of a smooth to rolling plain that was capped by light gray, limy sandstone of variable hardness. The surface of this plain has been modified considerably by successive periods of wind and water erosion, extensive deposition of sand, gravel, and silt, and a period of severe erosion.

The landscape in the northwestern and north-central parts of the county is a high plain, a remnant of the original smooth to rolling plain that has not been significantly modified by erosion.

The area extending northwest to southeast between Norden and Springview is a nearly level, broad plain that is 5 to 8 miles wide. This plain is the remnant of the large deposits of sand, gravel, and silt that covered the original sandstone plain. It slopes gradually eastward, and the relief is no more than 20 feet. In most of this area, a thin cap of loamy or silty loess overlies coarse sand and gravel. This landform, which is also found in the extreme northeastern part of the county, is the topmost formation in the county.

In the central and east-central parts of the county, the landscape is very mixed and consists of rolling to nearly level, sandy soils. This landform is lower than the sandstone-capped plain to the west. The sandy and loamy material in this area is derived from the original sandstone-capped plain. Wind and water have separated and blown this material, and the result is a hummocky topography. The drainage system in this area is poorly established because water is rapidly absorbed by the porous, sandy soils. As a result, many of the valley drainageways of this landform are wet.

The landscape consisting of the valley slopes and adjacent uplands on the north side of the Niobrara and Keya Paha Rivers has the most broken relief. These rivers and their tributaries have cut into the sandstone and removed most of the surface deposits of sand, gravel, and silt. The drainage system of this landscape is a deep, steep-sided, dendritic type separated by narrow divides. The base of this drainage system is mainly in Pierre Shale, which is the lowest formation exposed in the county. In places, the relief is more than 200 feet within a horizontal distance of 1,600 feet. Sandstone is exposed near the head of many drainageways, and there are remnants of sandstone on most of the higher and narrower divides in the Niobrara River Valley. Some of the outcrops of sandstone are nearly vertical. There are some nearly vertical exposures of the Brule Formation, a layer of light gray chalk between the sandstone and shale formation, on the slopes of the Niobrara River Valley.

The strongly sloping to steep uplands north of the Keya Paha River Valley developed mainly over Pierre Shale. This landform is 30 to 50 feet lower in elevation than the original sandstone-capped plain. Eight secondary drainage systems, running north to south and flowing into the Keya Paha River, severely dissect this upland area. Surface runoff is rapid, and erosion is severe. The surface features of this landscape generally are less harsh and less angular than those in the areas adjacent to the north side of the Niobrara River and both sides of the Keya Paha River; the drainage channels are less deeply entrenched, and the divides are lower and more rounded. In some of the level areas of this landscape, loess has been deposited over the Pierre Shale. These areas are 160 to 400 acres in size and the soils are suited to cultivation.

Alluvial soils are on the terraces and bottom lands along the rivers in the county. The terraces are 10 to 60 feet above the streams. The soils on these terraces are well drained. In many areas, the soils on bottom lands have a high water table and are subject to flooding. The surface of this alluvial landscape is nearly level except on some of the more sandy terraces where the wind has formed low hummocks and in areas where the landscape is dissected by stream channels.

Many stony areas are scattered throughout the central and eastern parts of the county. These areas are 50 to 100 feet higher than the surrounding plain, which overlies Pierre Shale or sand. Most are isolated hills that are less than 400 acres in size; some are more than 2

square miles in size. These stony areas are capped by remnants of harder sandstone beds, which have resisted erosion. Many of these areas are buttelike and have flat tops.

geology and ground water

Keya Paha County is underlain by bedrock of Cretaceous and Tertiary age. The oldest exposed formation is the Pierre Shale, which is of Cretaceous age. It is overlain successively by the Chadron and Brule Formations of Oligocene age, the Ogallala Formation of Pliocene age, and surficial deposits of Quaternary age.

Pierre Shale is exposed on the valley sides of the Keya Paha River and on the lower part of the valleys of its main tributaries. It is also exposed along the Niobrara River Valley and on the lower part of the tributary valleys as far west as R. 23 W.

The Chadron and Brule Formations are exposed in the southwestern part of the county on the valley sides of the Niobrara River. They consist of soft, light colored, cracked and fractured claystone and siltstone. There are springs and seep areas where water flows from this fractured stone.

The Ogallala Formation is dominant throughout the rest of the county. It consists of soft, light gray, lime-cemented sandstone that has lenses of uncemented silt, sand, gravel, and clay and some layers of hard sandstone.

The deposits of Quaternary age consist mainly of fine and medium sand and some gravel. Near natural lakes and in the larger stream valleys, the water-saturated layer in these deposits is thick enough that wells yield a small amount of water for domestic or livestock use.

All the water for public and domestic use and much of the water for livestock is obtained from wells. The Ogallala Formation is the main source of ground water in the county.

climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Summers in Keya Paha County usually are very warm and have frequent hot spells and occasional cool days. Winters are very cold due to the Arctic air that frequently surges over the area. Most precipitation falls during the warm seasons; it is normally heaviest late in spring and early in summer. Winter snowfall is normally not too heavy; the snow is blown into drifts, and much of the ground is free of snow.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Springview in the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 24 degrees F, and the average daily minimum temperature is 13 degrees. The lowest temperature on record, which occurred at Springview on January 29, 1966, is -26 degrees. In summer the average temperature is 73 degrees, and the average daily maximum temperature is 86 degrees. The highest recorded temperature, which occurred on July 13, 1954, is 110 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 20 inches. Of this, 16 inches, or 80 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 13 inches. The heaviest 1-day rainfall during the period of record was 3.91 inches at Springview on July 1, 1962. Thunderstorms occur on about 50 days each year, and most occur in summer. In small, scattered areas, the thunderstorms are accompanied by hail.

Average seasonal snowfall is 37 inches. The greatest snow depth at any one time during the period of record was 22 inches. On an average of 25 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year. Blizzards occur several times each winter.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 75 percent of the time possible in summer and 65 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 13 miles per hour, in April.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately.

The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows the soil associations in this county. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

soil descriptions

dominantly sandy and loamy soils on eolian and residual uplands

This group is made up of 6 associations. The soils are nearly level to steep and are excessively drained and well drained.

1. Valentine-Tassel association

Deep and shallow, gently sloping to steep, excessively drained and well drained sandy soils that formed in windblown material or in residuum of sandstone

This association consists of rolling to hilly, sandy soils on uplands. These soils are on hard-sandstone ridges and flat-topped buttes.

This association makes up about 16 percent of the county. The land area is about 79,000 acres. Valentine soils make up about 48 percent of the association, Tassel soils 29 percent, and minor soils 23 percent (fig. 1).

Valentine soils are hilly to rolling. They are deep and excessively drained. Permeability is rapid. Typically, the surface layer is very friable, dark grayish brown fine sand about 7 inches thick. The layer below that is loose, grayish brown fine sand about 9 inches thick. The underlying material, to a depth of 60 inches, is pale brown fine sand.

Tassel soils are gently sloping to steep. They are shallow and well drained. Permeablity is moderately rapid or rapid. Typically, the surface layer is very friable, dark grayish brown loamy fine sand about 5 inches thick. The subsurface layer is very friable, grayish brown fine sandy loam about 4 inches thick. The underlying material is light gray loamy sand that has fragments of sandstone. Consolidated white sandstone is at a depth of 13 inches.

The minor soils in this association are Duda, Dunday, Els, Manter, and Ronson soils. Duda and Ronson soils are moderately deep over sandstone. Duda soils are sandy and are in low, hummocky areas. Ronson soils are loamy and are nearly level. Dunday soils are deep, sandy soils that have a dark gray and dark grayish brown surface layer more than 10 inches thick. Els soils are deep, sandy soils in subirrigated areas. Manter soils are deep, loamy soils on the lower part of side slopes in the broader valleys.

About 80 percent of the acreage of this association is native rangeland that is used for grazing. The rest, which is made up of the gently sloping soils, generally is used for alfalfa. The main agricultural enterprise is raising livestock, mainly cows and calves; the calves are sold in the fall as feeders.

The main concern in managing the native rangeland in this association is maintaining or improving the range condition. In cultivated areas, the main concerns of management are controlling soil blowing and maintaining or improving the fertility of the soils. A large amount of crop residue on the surface and minimum tillage help to control soil blowing and maintain fertility. In a few areas, sufficient water is available for irrigation. In some areas, however, irrigation is not feasible or practical because of the characteristics and limitations of the soils.

On the average, the ranches and farms in this association are 1,500 acres in size; a few ranches are as much as 3,000 acres. Feeder calves are sold at local markets. There are a few gravel roads or improved dirt roads, which mainly provide access to the individual ranches. Most of these roads are along section lines, but some follow the topography around hills or wet areas.

2. Manter-Valentine association

Deep, nearly level to moderately steep, excessively drained and well drained sandy soils that formed in windblown material

This association consists of nearly level to moderately steep, sandy soils on rolling uplands. There are many swales in this association.

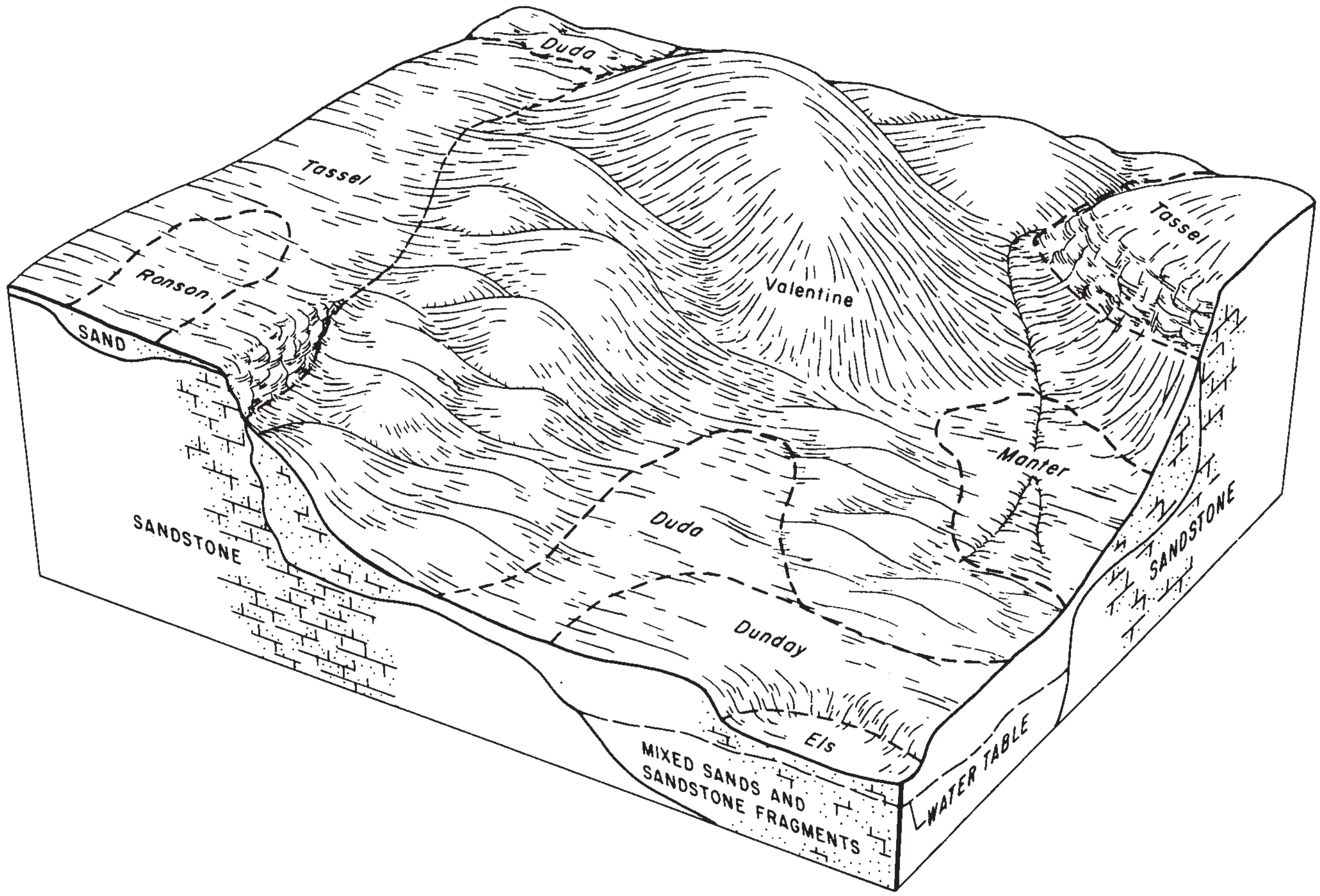


Figure 1.—Pattern of soils, topography, and underlying material in the Valentine-Tassel association.

This association makes up about 12 percent of the county. The land area is approximately 58,000 acres. Manter soils and similar soils make up about 38 percent of the association, Valentine soils and similar soils make up 36 percent, and minor soils 26 percent (fig. 2).

Manter soils are nearly level to moderately steep. They are deep and well drained. Permeability is moderately rapid. Typically, the surface layer is loose, dark grayish brown loamy fine sand about 6 inches thick. The subsurface layer is about 6 inches thick. It is very dark grayish brown, very friable fine sandy loam in the upper part and brown, very friable loamy fine sand in the lower part. The subsoil extends to a depth of 24 inches; it is friable, pale brown fine sandy loam. Sandstone is at a depth of about 48 inches.

Valentine soils are hilly to rolling. They are deep and excessively drained. Permeability is rapid. Typically, the surface layer is loose, dark grayish brown fine sand about 7 inches thick. The underlying material, to a depth of 60 inches, is pale brown fine sand.

The minor soils in this association are Duda, Holt, Ronson, Dunday, Ipage, Jansen, O'Neill, and Tuthill soils. Duda, Holt, and Ronson soils are moderately deep over sandstone; they are in higher positions on the landscape. Dunday and Ipage soils are deep, sandy soils on lesser slopes and in swales. Jansen and O'Neill soils are moderately deep over sand and gravel; they generally are on the highest ridgetops. Tuthill soils are nearly level, well drained, loamy soils in upland valleys.

The soils in this association are used mainly as rangeland. In some areas, they are used as cropland, hayland, or pasture that is irrigated using a center-pivot

sprinkler system. The main agricultural enterprise is raising livestock, mainly cows and calves; the calves are sold in the fall as feeders.

The main concern in managing the native rangeland in this association is maintaining or improving the range condition. In cultivated areas, the main concerns of management are controlling soil blowing and maintaining or improving the fertility of the soil. A large amount of crop residue on the surface, stripcropping, minimum tillage, and applying fertilizer help to control soil blowing, maintain fertility, and conserve moisture. In a few areas, sufficient water is available for irrigation. However, the potential for developing the supply of ground water for irrigation use is limited by the general thinness of the saturated, coarse-textured sediment that overlies the shale.

On the average, ranches and farms in this association are 1,500 acres in size; a few ranches are as much as 3,000 acres. Feeder cattle are sold at local markets.

There are a few gravel roads or improved dirt roads, which mainly provide access to the individual ranches. Most of these roads are along section lines, but some follow the topography around hills or wet areas. U.S. Highways 183 and 137 and Nebraska Highway 12 cross the areas of this association.

3. Tassel-Duda-Ronson association

Shallow and moderately deep, nearly level to moderately steep, well drained loamy and sandy soils that formed in windblown material or in residuum of sandstone

This association consists of nearly level loamy soils on a plain that is interrupted by areas of sandy hummocks and subirrigated lowlands. The sandy soils and subirrigated soils are nearly level to moderately steep or rolling.

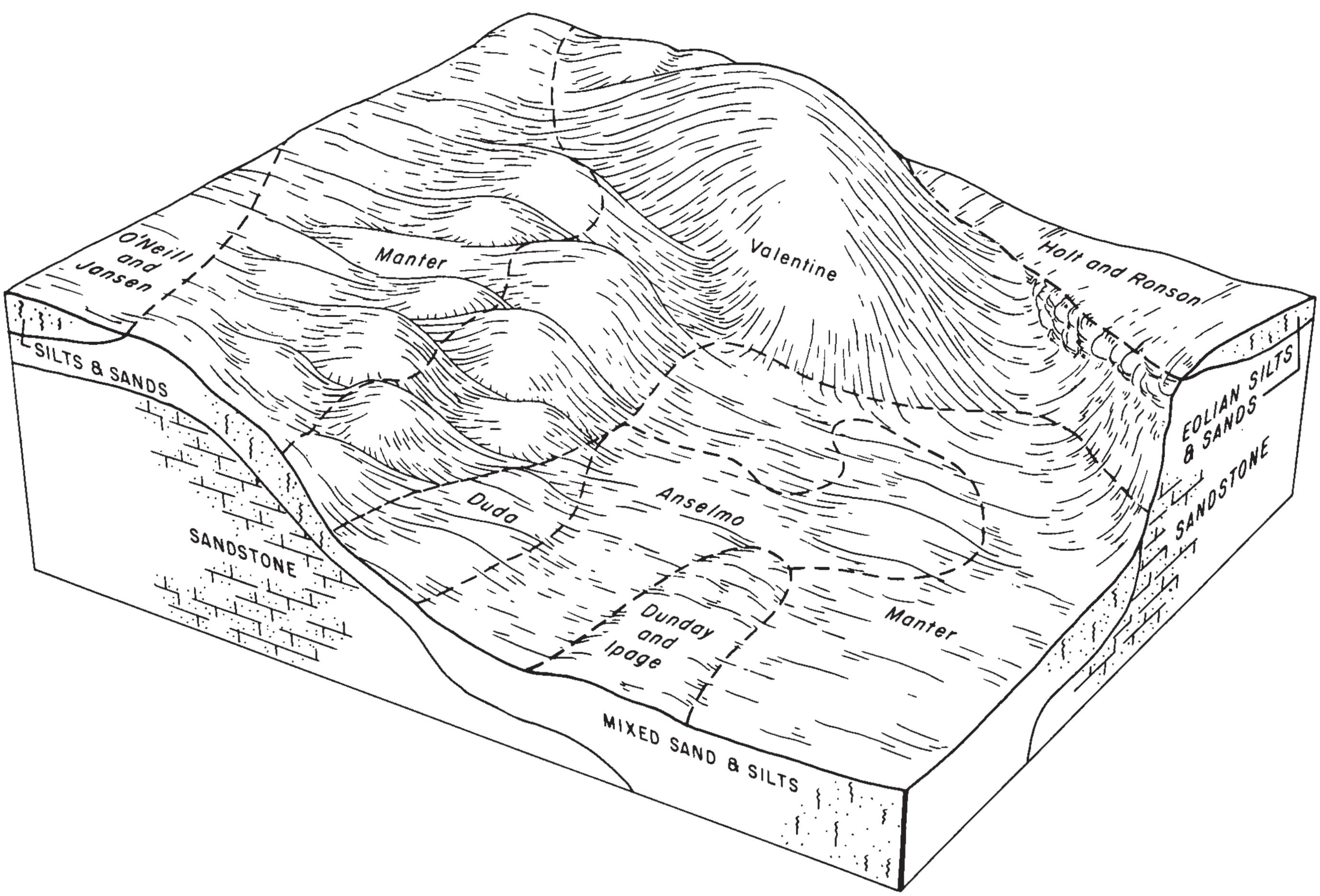


Figure 2.—Pattern of soils, topography, and underlying material in the Manter-Valentine association.

This association makes up about 11 percent of the county. The land area is about 52,000 acres. Tassel soils make up 24 percent of the association, Duda soils 21 percent, and Ronson soils 16 percent; Valentine soils make up 12 percent, and the other minor soils make up 27 percent.

Tassel soils are nearly level to moderately steep. They are shallow and well drained. These soils are mainly in large, flat areas where sandstone is within a depth of 20 inches. In some areas, they are on the steeper slope breaks along drainageways that have cut back into the tablelands. Permeability is moderately rapid or rapid above the sandstone. Typically, the surface layer is very friable, dark grayish brown fine sandy loam about 4 inches thick. The next layer is grayish brown, very friable fine sandy loam about 3 inches thick. The underlying material is light grayish brown fine sandy loam that has fragments of sandstone. Weakly cemented sandstone is at a depth of about 17 inches.

Duda soils are nearly level to strongly sloping. They generally are on low-lying hummocks and side slopes. These soils are well drained and are moderately deep over sandstone. Permeability is moderately rapid above the sandstone. Typically, the surface layer is dark grayish brown, loose loamy fine sand about 3 inches thick. The next layer is brown, loose fine sand about 9 inches thick. The underlying material is brown fine sand. Consolidated sandstone is at a depth of about 36 inches.

Ronson soils are nearly level to strongly sloping. These soils are well drained and are moderately deep over sandstone. Permeability is moderately rapid. Typically, the surface soil is very friable, grayish brown fine sandy loam about 13 inches thick. The next layer is friable, light gray fine sandy loam about 5 inches thick. The underlying material is white loamy sand that has weathered fragments of sandstone. Consolidated sandstone is at a depth of about 25 inches.

The minor soils in this association are Dunday, Ipage, Valentine, Meadin, O'Neill, Manter, Vetal, and Holt soils. Dunday and Ipage soils are deep, sandy soils in swales or on low hummocks. Valentine soils are deep, sandy soils on the larger hummocks. Meadin and O'Neill soils are shallow and moderately deep over sand and gravel; they are in the higher landscape positions. Manter and Vetal soils are deep and loamy, and Holt soils are moderately deep over sandstone; these soils are in level areas where the sandstone is at a depth ranging from 20 to more than 60 inches.

About 70 percent of the acreage of this association is native rangeland that is used for grazing. The rest is cropland. The main agricultural enterprise is raising livestock, mainly cows and calves; the calves are sold in the fall as feeders.

The main concern in managing the rangeland in this association is maintaining or improving the range condition. In cultivated areas, the main concerns of management are controlling soil blowing, maintaining or improving the fertility of the soils, and conserving moisture. Soil blowing can be reduced, moisture conserved, and fertility maintained by maintaining a cover of crops, grass, or crop residue on the soil. In a few areas, sufficient water is available for irrigation. However, the potential for developing the supply of ground water for use in irrigation is limited by the general thinness of the saturated, coarse-textured sediment that overlies the shale. The characteristics and limitations of the soils should be considered before developing an irrigation system.

On the average, the ranches and farms in this association are 1,500 acres in size; a few ranches are as much as 3,000 acres. Feeder calves are sold at local markets. There are a few gravel roads or improved dirt roads, which mainly provide access to the individual ranches. Most of these roads are along section lines, but some follow the topography around hills or wet areas. U.S. Highway 183 and Nebraska Highway 12 cross a small area of this association north and east of Springview.

4. Wewela-Valentine-Anselmo association

Moderately deep and deep, nearly level to steep, well drained and excessively drained loamy and sandy soils that formed in windblown material or in residuum of shale

This association consists of loamy and sandy soils that are underlain by clay at a depth between 1 and 20 feet. These soils are in a complex pattern on the landscape.

This association makes up about 7 percent of the county. The land area is about 33,000 acres. Wewela soils make up about 17 percent of the association, Valentine soils 16 percent, and Anselmo soils 11 percent; Ipage and O'Neill soils make up 10 percent each, and the other minor soils make up 36 percent.

Wewela soils are nearly level to strongly sloping. They are well drained and loamy. Permeability is moderate above the clayey material and very slow below that. Typically, the surface layer is gray, very friable fine sandy loam about 8 inches thick. The subsoil is grayish brown, firm sandy clay loam about 8 inches thick. The underlying material is light brownish gray and light olive brown clay. Bedded shale is at a depth of 36 inches.

Valentine soils generally are gently sloping to steep. They are deep, excessively drained, and sandy. Permeability is rapid. Typically, the surface layer is dark grayish brown, very friable fine sand about 7 inches thick. The layer below that is grayish brown, loose fine sand about 8 inches thick. The underlying material, to a depth of 60 inches, is pale brown fine sand.

Anselmo soils are nearly level to steep. They are deep and well drained. Permeability is moderately rapid. Typically, the surface soil is very friable, grayish brown fine sandy loam about 16 inches thick. The subsoil is very friable, grayish brown fine sandy loam about 6 inches thick. The underlying material, to a depth of 44

inches, is pale brown fine sandy loam; to a depth of 60 inches, it is light gray loamy fine sand.

The minor soils in this association are Dunday, Inavale, Ipage, Labu, Manter, O'Neill, and Sansarc soils. Dunday and Ipage soils are deep, sandy soils on low hummocks or in swales. Dunday soils have a dark surface layer more than 10 inches thick; Ipage soils do not. Inavale soils are deep, sandy soils on the bottom of narrow drainageways. Labu soils are strongly sloping to steep and are moderately deep over shale; they are on side slopes. Manter soils are deep, sandy soils on the upper part of side slopes and in level areas on uplands. O'Neill soils are nearly level and are moderately deep over sand and gravel. Sansarc soils are shallow over shale; they are in the steeper areas along drainageways that extend into this association.

About 80 percent of the acreage of this association is cropland. The rest is mainly native rangeland or tame-grass pastureland that is used for grazing. Most of the farms in this association are diversified, consisting of a combination of grain and livestock enterprises. Corn, small grains, and alfalfa are the main crops. Corn generally is grown on the irrigated cropland. Most of the pasture and rangeland is in areas of the steeper Anselmo and Valentine soils. On many farms, the grains that are produced are fed to the cattle or hogs. Cattle are either sold to a local market in the fall as feeder calves or are fattened on the farm. Hogs usually are fattened on the farm. Water for domestic use and livestock is available from shallow wells.

The main concern in managing the rangeland in this association is maintaining or improving the range condition. The main concerns in managing the cropland are controlling water erosion and soil blowing and conserving moisture. Water erosion and soil blowing can be reduced and soil moisture conserved by maintaining a cover of crops, grass, or crop residue.

Irrigation is limited mainly by the lack of deep wells. Most of the water for irrigation is supplied by the Keya Paha River and its tributaries. However, the present demand for this river water now exceeds the supply, so many irrigated crops do not receive enough water.

On the average, the farms in this association are 640 acres in size. Farm grain and livestock generally are sold to local markets or are shipped directly to larger markets in Omaha and Sioux City. Gravel or improved dirt roads are along most section lines. Nebraska Highway 12 crosses this association from east to west, and U.S. Highways 183 and 137 cross from north to south.

5. Anselmo-Labu association

Deep and moderately deep, gently sloping to steep, well drained loamy and clayey soils that formed in windblown material or in residuum of shale

This association consists of loamy and clayey soils on a deeply dissected landscape characterized by ridges, side slopes, and narrow valleys. The loamy soils generally are on ridgetops and the upper part of side slopes above the clayey soils. Many high ridgetops and some buttes are capped with quartzite. In places, shale has been exposed through the erosion of the sandstone plain. These soils formed in clayey, loamy, and sandy material.

This association makes up about 2 percent of the county. The land area is about 9,000 acres. Anselmo soils make up about 20 percent of the association, and Labu soils make up 13 percent; Ronson soils make up 10 percent, Wewela and Tassel soils 9 percent each, Sansarc and Ree soils 8 percent each, Schamber soils 7 percent, and the other minor soils 16 percent.

Anselmo soils are nearly level to steep. They are on the lower part of foot slopes, the upper part of side slopes, and ridgetops. These soils are deep and well drained. Permeability is moderately rapid. Typically, the surface soil is dark grayish brown, very friable fine sandy loam about 12 inches thick. The subsoil, to a depth of 30 inches, is brown, very friable fine sandy loam. The underlying material, to a depth of 60 inches, is grayish brown fine sandy loam.

Labu soils are strongly sloping to steep. They are on the middle and lower parts of side slopes of the smooth, more rounded knolls. These soils are moderately deep and well drained. Permeability is slow. Typically, the surface layer is dark grayish brown, firm silty clay about 5 inches thick. The subsoil, to a depth of 20 inches, is grayish brown, very firm clay. The underlying material is light olive brown clay. Bedded shale is at a depth of 36 inches.

The minor soils in this association are Ree, Ronson, Sansarc, Schamber, Tassel, Wewela, Manter, Mariaville, Valentine, and Verdel soils. Ree soils are deep, silty soils on flat ridgetops. Ronson soils are on the upper part of side slopes or on ridgetops; they are moderately deep over sandstone. Sansarc soils are on steep side slopes and are shallow over shale bedrock. Schamber soils are on ridgetops and are shallow over gravel. Tassel soils are on ridgetops and are shallow over sandstone. Wewela soils are on foot slopes or less sloping side slopes; they are moderately deep over shale. Manter soils are on the upper part of side slopes. Mariaville soils are on ridgetops and are shallow over siltstone. Valentine soils are deep, sandy soils on hummocks. Verdel soils are deep, clayey soils on colluvial foot slopes.

Most of the acreage of this association is native rangeland. In some areas, the less sloping soils are used as alfalfa hayland. The farms and ranches in this association generally include areas of soils in other associations that are favorable for cultivation. As a result, the farms generally are diversified, consisting of a combination of livestock and cropland enterprises. The livestock operations generally are cow-calf. The main crops on the soils in the adjacent association are corn, small grains, and alfalfa. The grain and hay generally are used as winter feed for the livestock raised on the soils

in this association. Surplus grain is sold at local markets or used for fattening cattle and hogs.

The major concerns in managing the rangeland in this association are controlling water erosion and conserving moisture. The soils are somewhat droughty because of the low available water capacity and the loss of water through runoff. Maintaining an adequate cover of vegetation and ground mulch helps to prevent excessive soil loss and conserve moisture by reducing runoff and evaporation. Overgrazing the rangeland reduces the vegetative cover and causes deterioration of the plant community. Proper stocking, uniform grazing, deferred grazing, and a planned grazing system help to keep the rangeland in good condition. Water for livestock is limited to precipitation that is caught and stored in stockwater ponds and water drawn from shallow wells. Water that is drawn from shallow wells for domestic use should be checked frequently for contamination.

The farms and ranches in this association generally are about 1,280 acres in size; a few are as much as 3,000 acres. Feeder cattle, feeder calves, and hogs generally are sold at local markets or are shipped to larger markets in Omaha and Sioux City. The few gravel or improved dirt roads that cross areas of this association generally do not follow section lines. These roads mainly provide access to the farms or ranches. The Schamber soils are used as a source of low-grade aggregate for surfacing local county roads. No highways cross this association.

6. Valentine association

Deep, gently rolling to hilly, excessively drained sandy soils formed in windblown material

This association consists of gently rolling to hilly soils on a plain of eolian sands.

This association makes up about 10 percent of the county. The land area is about 51,000 acres. Valentine soils make up 73 percent of the association, and minor soils make up the rest.

Valentine soils are gently rolling to hilly. They are on hummocky and dunelike uplands. These soils are deep and excessively drained. Permeability is rapid. Typically, the surface layer is dark grayish brown, very friable fine sand about 7 inches thick. The layer below that is grayish brown, loose fine sand about 8 inches thick. The underlying material, to a depth of 60 inches, is pale brown fine sand.

The minor soils in this association are Anselmo, Dunday, Els, Ipage, Loup, and Manter soils. Anselmo soils are deep, loamy soils on the more gentle slopes. Dunday and Ipage soils are deep, sandy soils in swales. Els soils are deep, sandy soils; they have a water table at a depth between 24 and 42 inches. Loup soils are in the lowest positions on the landscape; they are saturated with water below a depth of 10 inches. Manter soils are similar to Anselmo soils except that they have an accumulation of clay in the subsoil.

The soils in this association are used mainly as rangeland. In a few small areas, the more gently sloping soils in the association are used as irrigated cropland. The ranches and farms in this association are mainly cow-calf operations. Some of the farms include soils in other associations that have better potential for crops. As a result, these farms tend to be diversified, including grain and livestock operations.

The main concern in managing rangeland is controlling soil blowing caused by overgrazing or by using improper haying methods. The main concerns in managing cropland are controlling soil blowing, conserving moisture, and improving the fertility of the soils. Maintaining crop residue on the surface, stripcropping, minimum tillage and applying fertilizer help to control soil blowing, conserve moisture, and improve fertility.

On the average, the farms and ranches in this association are 1,600 acres in size. Livestock generally is sold at local auctions or at markets in Sioux City or Omaha. There are gravel or improved dirt roads in this association. U.S. Highways 187 and 137 and Nebraska Highway 12 cross the areas of this association.

dominantly sandy and loamy soils in broad upland valleys

The soils in this group are nearly level and very gently sloping and are moderately well drained to very poorly drained.

7. Ipage-Loup-Ord association

Deep, nearly level and very gently sloping, moderately well drained to very poorly drained sandy and loamy soils that formed in windblown and alluvial material

This association consists of nearly level and very gently sloping soils in broad valleys (fig. 3). The valleys are about 1 to 2 miles wide. In many areas, the soils have a perched water table in spring or in periods of above average rainfall.

This association makes up about 11 percent of the county. The land area is about 56,000 acres. Ipage soils make up about 22 percent of the association, Loup soils 20 percent, and Ord soils 17 percent; Els and Elsmere soils make up 30 percent of the association, and the other minor soils make up 11 percent.

Ipage soils are nearly level and very gently sloping; in some areas, they are gently undulating. These soils are deep and moderately well drained. Permeability is rapid. Typically, the surface layer is dark gray, very friable loamy fine sand about 6 inches thick. The layer below that is brown fine sand about 8 inches thick. The underlying material, to a depth of 60 inches, is pale brown and light gray fine sand. Between depths of 14 and 36 inches, the soil has yellowish brown mottles.

Loup soils are deep, nearly level, poorly drained and very poorly drained soils on bottom lands. Permeability is rapid. These soils generally have a water table at a depth of 10 to 18 inches. Typically, a 1-inch thick layer

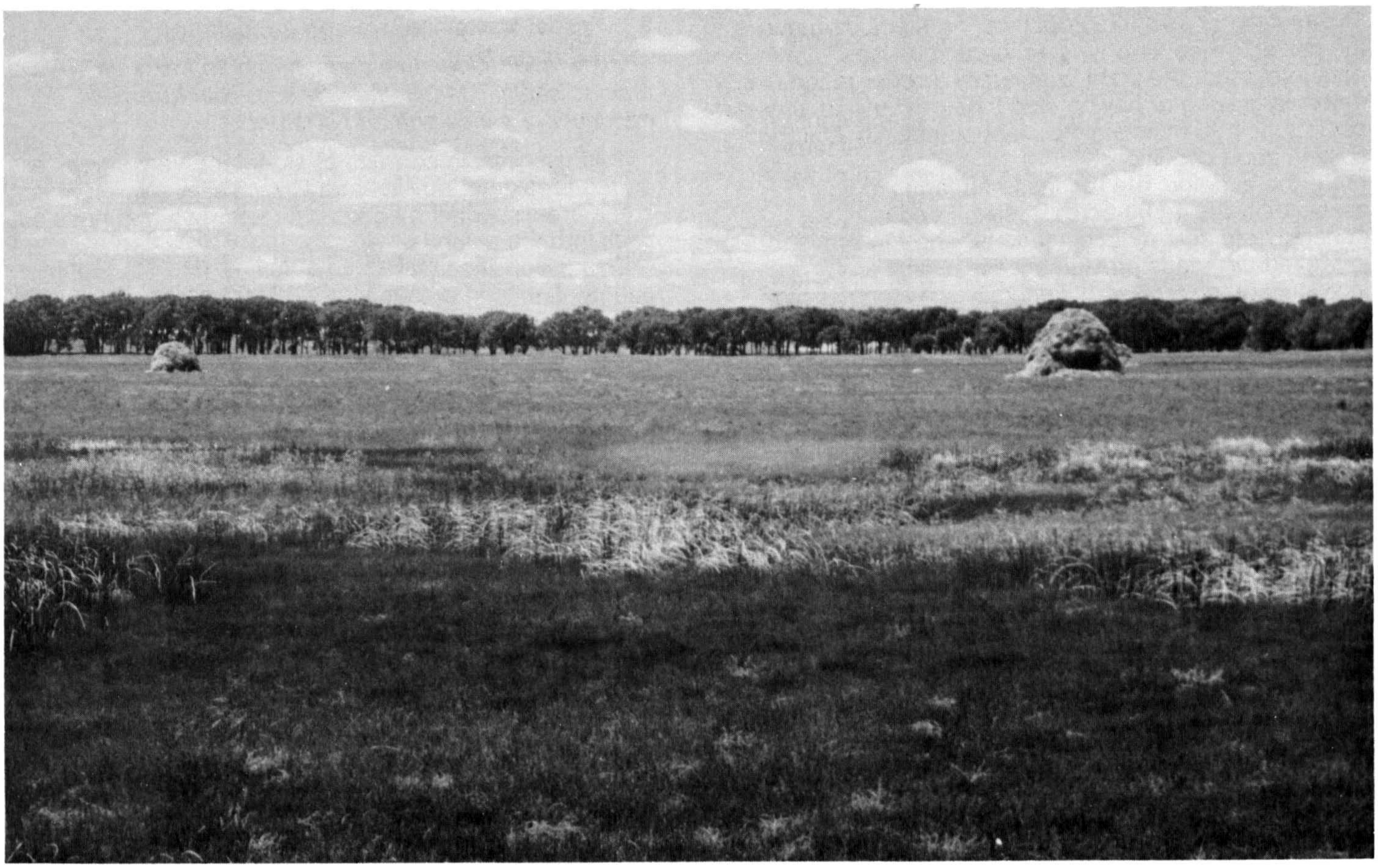


Figure 3.—An area of the Ipage-Loup-Ord association. Ipage and Ord soils are in the background, and Loup soils are in the foreground.

of partly decomposed leaves and stems overlies the surface layer. The surface layer is dark gray, friable fine sandy loam 11 inches thick. The layer below that is light brownish gray loamy fine sand about 3 inches thick. The underlying material, to a depth of 60 inches, is light gray fine sand; it has strata of lighter or darker and finer or coarser textured material.

Ord soils are deep, somewhat poorly drained, loamy soils on bottom lands. Permeability is moderately rapid. These soils have a water table at a depth between 18 and 42 inches. Typically, the surface soil is calcareous, gray fine sandy loam about 12 inches thick. The layer below that is calcareous, friable, light gray loam about 12 inches thick. The underlying material, to a depth of 36 inches, is light gray fine sandy loam; to a depth of 60 inches, it is fine sand or sand that has strata of finer and coarser textured material.

The minor soils in this association are Els, Elsmere, Inavale, Manter, and Valentine soils. Els and Elsmere soils are sandy soils in swales; they have a water table at a depth between 18 and 42 inches. Inavale soils are deep, sandy soils on stream terraces. Manter soils are deep, loamy soils on foot slopes. Valentine soils are deep, sandy soils on hummocks.

Most of the acreage of this association is native rangeland that is used for hay or grazing. In a few small areas, the soils are used as cropland. The farms and ranches in this association generally are cow-calf operations; the calves are sold in the fall as feeders. The soils in this association are used mainly for producing hay, which is used as feed for the cows in winter. The main limitation to the use of these soils is wetness caused by the high water table.

Where these soils are cultivated, the main crops are corn, alfalfa, and sorghum. The cultivated cropland generally is irrigated. The main concerns in managing cropland are controlling soil blowing, maintaining fertility, and preventing water from ponding in the lower areas.

The main concerns in managing hayland or rangeland are maintaining the productivity of the grass and insuring good distribution of livestock in the wetter areas.

Overgrazing or using improper haying methods reduces the protective cover of vegetation and causes deterioration of the plant community. Proper range use, deferred grazing or haying, and restricted use in very wet periods help to maintain the plant community and the soils in good condition.

On the average, the ranches and farms in this association are 1,500 acres in size. Feeder calves generally are sold at local markets. The few gravel or improved dirt roads provide access mainly to the individual ranches. Roads generally are along section lines; however, in many places the roads veer away from the section lines to avoid small wet areas and marshes. U.S. Highways 183 and 137 and Nebraska Highway 12 cross the areas of this association.

dominantly sandy, loamy, and silty soils on breaks to the Niobrara River Valley

The soils in this group are steep and very steep and are well drained.

8. Tassel-Mariaville-Ronson association

Shallow and moderately deep, steep and very steep, well drained sandy, loamy, and silty soils that formed in residuum of sandstone and siltstone

This association consists of steep and very steep soils on the breaks to the Niobrara River Valley (fig. 4). Most areas are dissected by deep drainageways that have cut back into the uplands.

This association makes up about 11 percent of the county. The land area is about 53,000 acres. Tassel soils make up about 21 percent of this association, Mariaville soils 14 percent, and Ronson soils 11 percent; Valentine and Duda soils make up 10 percent each, and the other minor soils make up 34 percent.

Tassel soils are sandy and are shallow over sandstone. They are on the upper part of the steep to very steep breaks. Typically, the surface layer is dark grayish brown, very friable loamy fine sand about 4 inches thick. The layer below that is light gray, very friable fine sand about 8 inches thick. The underlying

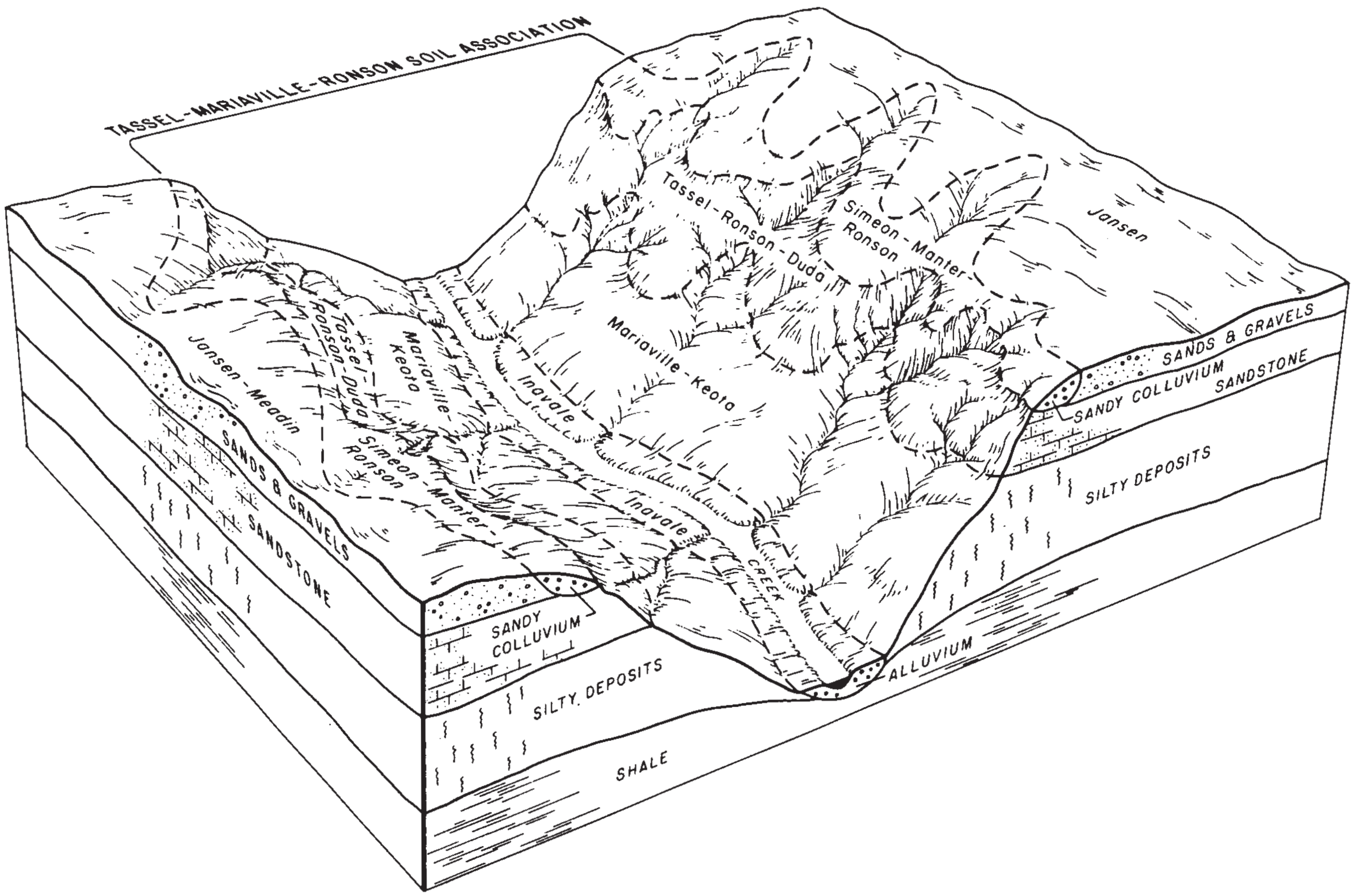


Figure 4.—Pattern of soils, topography, and underlying material in the Tassel-Mariaville-Ronson association.

material consists of light gray sand and sandstone fragments; more consolidated sandstone is at a depth of about 18 inches.

Mariaville soils are silty and are shallow over siltstone. They are on the lower part of the steep to very steep breaks. Typically, the surface layer is grayish brown, very friable silt loam about 4 inches thick. The layer below that is pale brown, very friable silt loam about 6 inches thick. The underlying material is very pale brown silt loam; siltstone is at a depth of about 16 inches.

Ronson soils are loamy and are moderately deep over sandstone. They are on the steep breaks. Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 4 inches thick. The subsurface layer is grayish brown, very friable fine sandy loam about 5 inches thick. The layer below that is light gray, very friable fine sandy loam about 14 inches thick. The underlying material is very pale brown fine sandy loam; white consolidated sandstone is at a depth of about 35 inches.

The minor soils in this association are Valentine, Duda, Anselmo, Inavale, Keota, Manter, Munjor, and Paka soils. Valentine and Duda soils are sandy and are in areas where sand has blown across the steep slopes. Valentine soils are deep over sandstone, and Duda soils are moderately deep. Anselmo soils are loamy and are on the upper part of ridges and on less steep slopes. Inavale soils are sandy and are along drainageways. Keota soils are steep and are moderately deep over siltstone. Manter soils are in positions on the landscape similar to those of Anselmo soils. Munjor soils are deep, loamy soils on the lower part of side slopes and on rolling ridgetops.

All the soils in this association are in native vegetation of grass and trees. The trees are mainly ponderosa pine; the stands of trees generally are thin, but in some areas they are thick enough to force out the grass. Broad-leaved trees are on the lower part of most side slopes. These soils are not suitable for use as cropland. The farms and ranches in this association generally include soils in other associations that are suited to cultivation and grazing. The soils in this association are mainly used for summer grazing. The main livestock enterprise is producing feeder calves that are sold at markets in the fall.

The production of grass on these soils is limited by the low rainfall, the shallowness of the soils, the steepness of slopes, and the density of the tree canopy. Water for livestock is limited to precipitation that is caught and stored in stockwater ponds and water from the small streams. Water erosion is a severe hazard if the vegetative cover is destroyed or has deteriorated by overgrazing. Grazing needs to be carefully controlled to maintain the vegetative cover and control erosion.

On the average, the farms and ranches in this association are 1,500 acres in size. The grain and livestock produced generally are sold at local markets or at the larger markets in Omaha and Sioux City. The few gravel or improved dirt roads that cross this association generally do not follow section lines. U.S. Highway 183 crosses this association.

dominantly loamy soils underlain by sand and gravel; on uplands

This group is made up of 2 soil associations. The soils are nearly level to steep and are excessively drained and well drained.

9. Meadin-Jansen-O'Neill association

Nearly level to steep, well drained and excessively drained loamy soils that are shallow or moderately deep over sand and gravel; these soils formed in loamy and loesslike material

This association consists of nearly level to steep soils on divides and the upper part of side slopes. These soils formed in loamy and sandy material over gravelly outwash. The landscape is irregular, and there are many uncrossable gullies on the side slopes.

This association makes up about 7 percent of the county. The land area is about 37,000 acres. Meadin soils make up about 31 percent of the association, Jansen soils 25 percent, O'Neill soils 21 percent, and minor soils 23 percent (fig. 5).

Meadin soils are excessively drained and are nearly level to steep. Permeability is rapid in the surface layer and very rapid in the underlying material. Typically, the surface layer is dark gray, loose, gravelly sandy loam about 7 inches thick. The layer below that is brown, loose, gravelly loamy sand about 4 inches thick. The underlying material, to a depth of 33 inches, is light brownish gray, very gravelly sand; to a depth of 60 inches, it is light gray sand.

Jansen soils are nearly level to gently sloping. They are moderately deep over sand and gravel and are well drained. Permeability is moderate in the surface layer and subsoil and very rapid in the underlying material. Typically, the surface layer is dark grayish brown, friable loam about 9 inches thick. The subsoil, extends to a depth of 24 inches; it is grayish brown and brown, firm clay loam. The underlying material, to a depth of 27 inches, is light grayish brown loamy sand; to a depth of 60 inches, it is light gray gravelly sand.

O'Neill soils are nearly level to strongly sloping. They generally are in slightly higher positions on the landscape than Meadin soils. These soils are moderately deep over sand and gravel and are well drained. Permeability is moderately rapid in the surface layer and subsoil and very rapid in the underlying material. Typically, the surface soil is dark grayish brown, very friable fine sandy loam about 13 inches thick. The subsoil is brown, friable sandy loam about 11 inches thick. The underlying material, to a depth of 60 inches, is stratified gravelly sand.

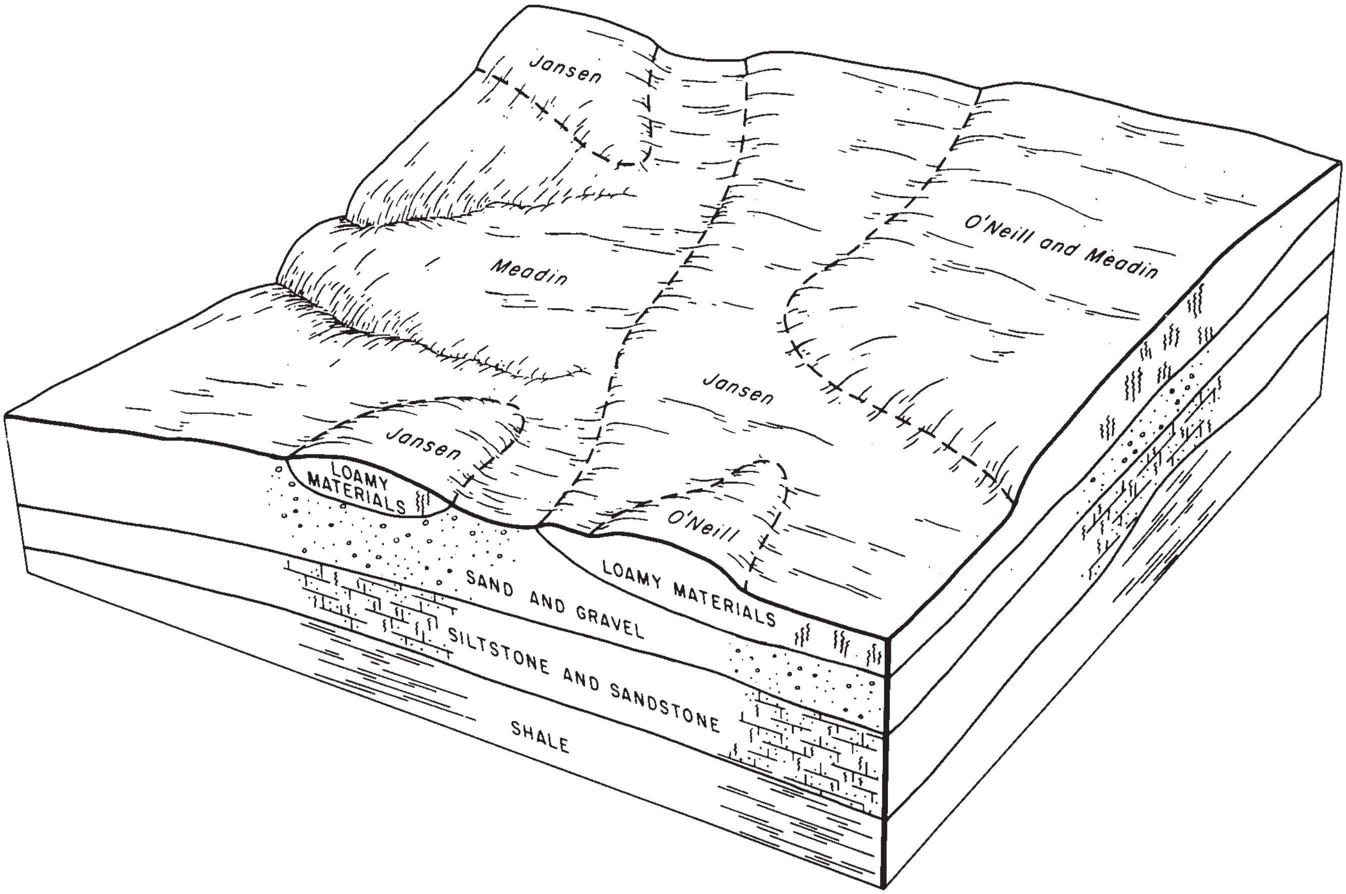


Figure 5.—Pattern of soils, topography, and underlying material in the Meadin-Jansen-O'Neill association.

The minor soils in this association are Anselmo, Brocksburg, Manter, Ronson, Simeon, and Valentine soils. Anselmo soils are deep, loamy soils in higher positions than the major soils. Brocksburg soils have a thicker surface layer, are in higher positions on the landscape, and generally are more gently sloping than Jansen soils. Manter soils are deep, loamy soils that have an accumulation of clay in the subsoil. Ronson soils are gently sloping and are moderately deep over sandstone. Simeon soils are level sandy soils that are shallow over coarse sand. Valentine soils are deep, sandy soils in higher positions on the landscape.

About two-thirds of the acreage of this association is native rangeland where the soils mainly are shallow and steep. The soils that are cultivated are mainly moderately deep and nearly level to gently sloping. The farms and ranches in this association are diversified. They are used for producing livestock, including cow-calf operations, feeder cattle, and hogs, and for cash grains. The nonirrigated land is used for grass or alfalfa for grazing or hay. On the irrigated land, corn, small grains, and alfalfa are the main crops. The water from wells is sufficient for livestock and domestic use.

The main concerns in managing the rangeland and cropland in this association are controlling soil blowing, conserving moisture, and maintaining or improving the fertility of the soils. The low available water capacity is a limitation. On cultivated land, maintaining a cover of crop residue on the surface, stripcropping, minimum tillage, and applying fertilizer can help to control soil blowing, maintain fertility, and improve the water-holding capacity of the soils. On rangeland, proper stocking and a planned grazing system can help to control erosion and to maintain or improve the vigor of the grasses. Because of a limited amount of available irrigation water, good water management is necessary.

On the average, the farms in this association are 480 acres in size. Grains and livestock generally are sold at

local markets or at the larger markets in Omaha and Sioux City. Gravel or improved dirt roads are along most section lines. Nebraska Highways 12 and 7 and U.S. Highway 183 cross the areas of this association.

10. Jansen-Brocksburg-O'Neill association

Nearly level to gently sloping, well drained loamy soils that are moderately deep over sand and gravel; these soils formed in loamy and loesslike material

This association consists of nearly level to gently sloping, moderately deep soils on uplands. These soils have a thin layer of loamy material underlain by gravelly outwash sediment.

This association makes up about 2 percent of the county. The land area is about 9,500 acres. Jansen soils make up about 37 percent of this association, Brocksburg soils 28 percent, O'Neill soils 21 percent, and minor soils 14 percent.

Jansen soils are nearly level to gently sloping. They are moderately deep over sand and gravel and are well drained. Permeability is moderate in the surface layer and subsoil and very rapid in the underlying material. Typically, the surface layer is dark grayish brown, friable loam about 9 inches thick. The subsoil is grayish brown and brown, firm clay loam about 15 inches thick. The underlying material, to a depth of 27 inches, is light brownish gray loamy sand; to a depth of 60 inches, it is light gray gravelly sand.

Brocksburg soils are nearly level and generally are in slightly higher positions on the landscape than Jansen soils. They are moderately deep over sand and gravel and are well drained. Permeability is moderate in the surface soil and subsoil and very rapid in the underlying material. Typically, the surface soil is friable, very dark grayish brown loam about 15 inches thick. The subsoil is grayish brown and dark grayish brown, firm clay loam about 12 inches thick. The underlying material, to a depth of 30 inches, is brown loam; to a depth of 60 inches, it is pale brown gravelly sand.

O'Neill soils are nearly level to strongly sloping and generally are in slightly higher positions on the landscape than Jansen and Brocksburg soils. They are moderately deep over sand and gravel and are well drained. Permeability is moderately rapid in the upper part of the soil and very rapid in the underlying material. Typically, the surface soil is dark grayish brown, very friable fine sandy loam about 13 inches thick. The subsoil is brown, friable sandy loam about 11 inches thick. The underlying material, to a depth of 60 inches, is gravelly sand.

The minor soils in this association are Dunday, Manter, Meadin, and Vetal soils. Dunday soils are sandy and are in slightly higher positions on the landscape than Brocksburg soils. Manter soils are deep, sandy soils that have a slight accumulation of clay in the subsoil. Meadin soils are shallow over sand and gravel and are in nearly level areas and on side slopes. Vetal soils are deep, nearly level, and loamy.

Most of the acreage of this association is cropland. There are a few small, irregularly shaped areas where the soils are used as native rangeland. The farms and ranches in this association are diversified, consisting of a combination of grain and livestock enterprises. They are used for producing livestock, including cow-calf operations, feeder cattle, and hogs, and for cash grains. The nonirrigated land is used mainly for alfalfa or grass for pasture or hay; in some areas, it is used for row crops and small grains. Most of the nonirrigated land is livestock oriented. On irrigated land, corn, small grains, and alfalfa are the main crops. The water from wells is sufficient for livestock and domestic use.

The hazard of soil blowing and the droughtiness, low available water capacity, and low fertility of the soils are the main concerns of management. On the cropland in this association, maintaining a cover of crop residue on the surface, stripcropping, minimum tillage, and applying fertilizer can help to control soil blowing, maintain fertility, and improve the water-holding capacity of the soils. On rangeland, proper stocking and a planned grazing system can help to maintain or improve the vigor of the grasses. Because of limited irrigation water, good water management is necessary.

On the average, the farms in this association are 480 acres in size. The grain and livestock generally are sold at local markets or at the larger markets in Omaha and Sioux City. Gravel roads are along most section lines. Nebraska Highway 7, a gravel road, crosses the areas of this association.

dominantly clayey soils on residual uplands

This group consists of strongly sloping to very steep, well drained clayey soils.

11. Labu-Sansarc association

Moderately deep and shallow, strongly sloping to very steep, well drained clayey soils that formed in residuum of shale

This association consists of strongly sloping to very steep, clayey soils that formed in residuum of shale. The landscape is deeply dissected (fig. 6). These soils are on side slopes and breaks along all the major drainageways and many minor ones.

This association makes up about 5 percent of the county. The land area is about 24,000 acres. Labu soils make up about 38 percent of the association, Sansarc soils 35 percent, and minor soils 27 percent (fig. 7).

Labu soils are strongly sloping to steep. They are on the lower part of foot slopes and on the smooth, more rounded knolls of hillsides. These soils are moderately deep and well drained. Permeability is slow. Typically, the surface layer is dark grayish brown, firm silty clay about 5 inches thick. The subsoil is grayish brown, very firm clay about 15 inches thick. The underlying material

Figure 6.—An area of the Labu-Sansarc association. Labu soils are on the lower foot slopes and on the smoother, more rounded knolls of the hillsides. Sansarc soils are on the steeper and higher slopes.

is light olive brown clay. Bedded shale is at a depth of 36 inches.

Sansarc soils are steep to very steep. They generally are in the higher and steeper positions on the landscape. These soils are shallow and well drained. Permeability is slow. Typically, the surface layer is dark grayish brown, friable silty clay about 4 inches thick. The underlying material is calcareous, grayish brown and light brownish gray clay. Light gray bedded shale is at a depth of about 14 inches.

The minor soils in this association are Anselmo, Mariaville, Reliance, and Verdel soils. Anselmo soils are deep and are on the upper part of side slopes and on ridgetops. Mariaville soils are on ridgetops and are shallow over siltstone. Reliance soils are deep, silty soils on convex ridges and side slopes. Verdel soils are deep, clayey soils on colluvial foot slopes.

Most of the acreage of this association is native rangeland. In some areas, the less sloping soils are used as alfalfa hayland. The farms and ranches in this association generally include soils in other associations that are also used as rangeland or hayland. They are mainly livestock enterprises engaging in cow-calf operations. Most of the grain and hay produced on these soils is used in winter as feed for the cattle.

The major concerns in managing the rangeland in this association are controlling water erosion and conserving moisture. The soils are somewhat droughty because of

the low available water capacity and the loss of water through runoff. Maintaining an adequate cover of vegetation and ground mulch helps to reduce runoff, thus preventing excessive soil loss and improving the moisture supply. Overgrazing the rangeland reduces the vegetative cover and causes deterioration of the plant community. Proper stocking, uniform grazing, deferred grazing, and a planned grazing system help to keep rangeland in good condition. Water for livestock is limited to precipitation that is caught and stored in stockwater ponds and water drawn from the few shallow wells. Because the wells are shallow, the water that is drawn for domestic use should be checked periodically for contamination.

On the average, the farms and ranches in this association are 1,280 acres in size. Feeder calves generally are sold in the fall at local markets or at the larger markets in Omaha and Sioux City. The few gravel or improved dirt roads that cross this association generally do not follow section lines.

dominantly sandy, loamy, and silty soils on flood plains and terraces

This group consists of nearly level to strongly sloping, well drained and somewhat excessively drained soils.

12. Inavale-Cass-Verdel association

Deep, nearly level to strongly sloping, well drained and somewhat excessively drained sandy, loamy, and silty soils that formed in deposits of alluvial and colluvial material

This association consists of soils on narrow bottom lands, low terraces, and foot slopes adjacent to the

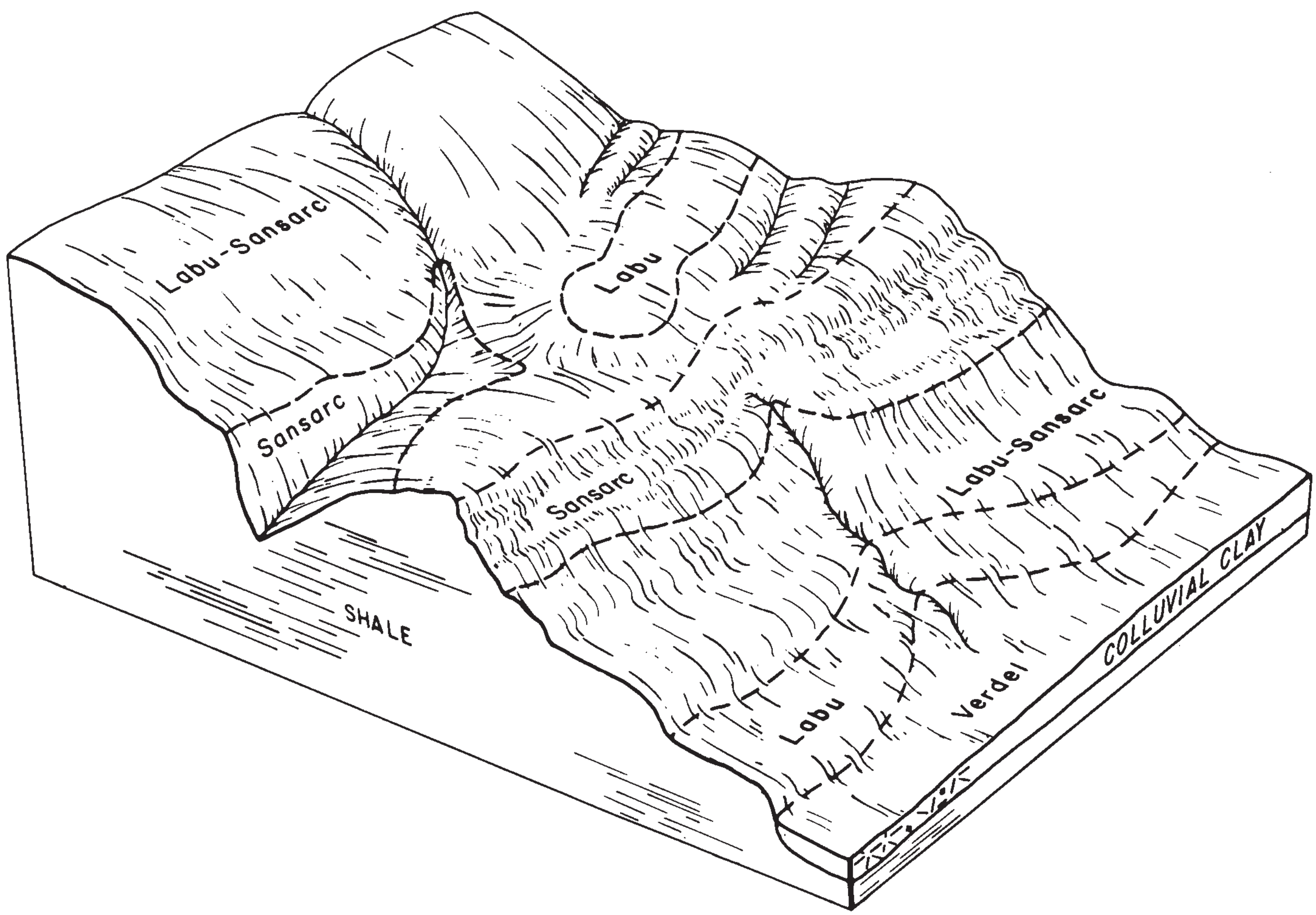


Figure 7.—Pattern of soils, topography, and underlying material in the Labu-Sansarc association.

Niobrara and Keya Paha Rivers. These soils mainly are nearly level. They are more sloping in areas where the river has abandoned channels, about five feet deep or where sandy alluvium has been reworked by wind into hummocks 5 to 25 feet high.

This association makes up about 3 percent of the county. The land area is about 15,000 acres. Inavale soils make up 52 percent of the association, Cass soils about 14 percent, Verdel soils 13 percent, and minor soils 21 percent (fig. 8).

Inavale soils generally are nearly level and strongly sloping. They are deep, sandy soils and are somewhat excessively drained. Permeability is rapid. Typically, the surface layer is grayish brown, very friable loamy fine sand about 5 inches thick. The layer below that is light brownish gray, loose fine sand about 10 inches thick. The underlying material, to a depth of 60 inches, is light gray sand that has strata of fine sand and gravelly sand.

Cass soils are deep, nearly level, loamy soils on terraces that generally are only a few feet higher than the bottom lands. These soils are farther from the river channel than Inavale soils. They are well drained and have moderately rapid permeability. Typically, the surface layer is friable, dark grayish brown loam about 6 inches thick. The subsurface layer is very friable, dark grayish brown loam about 4 inches thick. The layer below that is very friable, grayish brown fine sandy loam about 4 inches thick. The underlying material, to a depth of 20 inches, is pale brown very fine sandy loam. It is underlain by a buried layer of dark gray fine sandy loam about 20 inches thick. Below that, to a depth of 60 inches, the soil is light brownish gray loamy fine sand.

Verdel soils are deep, nearly level to gently sloping, clayey soils on terraces and foot slopes adjacent to steep breaks to the uplands. These soils are well drained and have slow permeability. Typically, the surface soil is dark grayish brown, friable silty clay loam about 18 inches thick. The subsoil, to a depth of 36 inches, is dark grayish brown, firm silty clay. The underlying material, to a depth of 60 inches, is grayish brown clay.

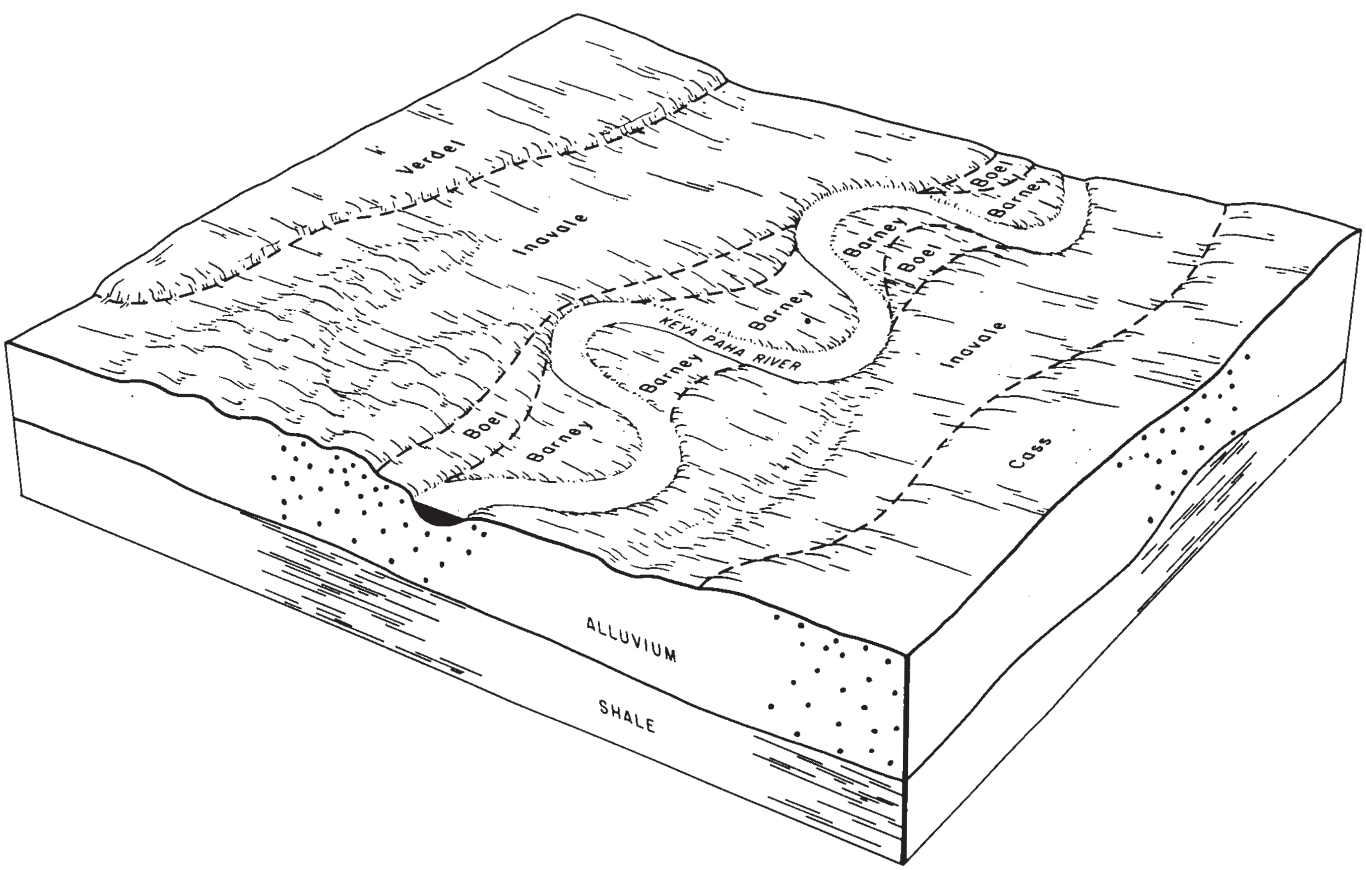


Figure 8.—Pattern of soils, topography, and underlying material in the Inavale-Cass-Verdel association.

The minor soils in this association are Albaton, Barney, Boel, and Loup soils. Albaton soils are poorly drained clayey soils on the bottom of drainageways. Barney soils are poorly drained sandy soils adjacent to channels of the Niobrara River and other streams. Boel soils are somewhat poorly drained sandy soils on bottom lands that are slightly higher and farther from the river channel than Barney soils. Loup soils are similar to Barney soils except that they have a thicker surface layer and do not have gravel in the profile.

About 60 percent of the acreage of this association is cropland. The rest is native grassland that has some scattered broad-leaved trees. Most of the cropland is on the higher bottom lands and terraces, which are the farthest from the stream channel. The soils that are used as rangeland generally are coarser textured and are in areas that are dissected by channels and are occasionally flooded.

The farms in this association are diversified, consisting of a combination of grain and livestock enterprises. Corn, small grains, and alfalfa are the main crops. The cropland that is used for corn generally is irrigated. River water is used for the irrigation. The livestock operations generally are cow-calf, and the calves are sold in the fall as feeders. Some cattle and hogs are fattened on the farms. The grain and hay produced generally are used for fattening livestock or as winter feed.

The main concerns in managing the cropland in this association are controlling soil blowing, maintaining fertility, and conserving moisture. A conservation tillage system generally is needed to control erosion. The main concerns in managing the native rangeland are maintaining or improving the grass community and controlling erosion. Overgrazing or using improper haying methods will cause the grass community to deteriorate.

On the average the farms in this association are 360 acres in size. Most of the farms include soils in other associations. The grain and livestock produced are sold at local markets or at the larger markets in Omaha and Sioux City. The access to many farms is poor, and travel is limited to 4-wheel drive vehicles in winter and rainy periods. U.S. Highways 183 and 137 and Nebraska Highways 12 and 7 cross the areas of this association.

dominantly loamy and silty soils on eolian and residual uplands

This group is made up of two soil associations. The soils are nearly level to strongly sloping and are well drained.

13. Vetal-Holt association

Deep and moderately deep, nearly level to strongly sloping, well drained loamy soils that formed in loess and loamy material or in residuum of sandstone

This association consists of nearly level to strongly sloping loamy soils on broad upland plains. It makes up about 2 percent of the county. The land area is about 10,000 acres. Vetal soils make up 42 percent of this association, Holt soils 24 percent, and minor soils 34 percent.

Vetal soils are deep, nearly level to gently sloping, loamy soils. These soils generally are in concave positions on the uplands. They are well drained, and permeability is moderately rapid. Typically, the surface layer is friable, dark grayish brown loam about 6 inches thick. The subsurface layer is friable, dark gray loam about 12 inches thick. The layer below that, to a depth of 47 inches, is dark grayish brown, dark brown, and brown loam. The underlying material, to a depth of 54 inches, is pale brown loam; below that it is very pale brown loamy fine sand.

Holt soils are nearly level to strongly sloping, loamy soils that are moderately deep over sandstone. These soils are well drained and generally are in convex positions on the landscape. Permeability is moderate above the sandstone. Typically, the surface layer is very friable, dark grayish brown fine sandy loam about 6 inches thick. The subsurface layer is very friable, very dark grayish brown fine sandy loam about 4 inches thick. The subsoil extends to a depth of about 21 inches; it is dark grayish brown and brown fine sandy loam. The underlying material is light gray, calcareous loamy fine sand. Consolidated sandstone is at a depth of about 34 inches.

The minor soils in this association are Anselmo, Duda, Manter, Meadin, and O'Neill soils. Anselmo soils are deep, nearly level to strongly sloping loamy soils. Duda soils are moderately deep, sandy soils on hummocks. Manter soils are deep, loamy soils that have a slight accumulation of clay in the subsoil; they are in landscape positions similar to those of Anselmo soils. Meadin soils are shallow over sand and gravel; they are on the higher ridges and in level areas. O'Neill soils are moderately deep over sand and gravel; they are in landscape positions similar to those of Meadin soils.

Most of the acreage of this association is cropland. There are a few small, irregularly shaped areas where the soils are used as native rangeland. The cropland consists mainly of the level to gently sloping soils. The farms and ranches in this association are diversified, consisting of a combination of grain and livestock enterprises. They are used for producing livestock, including cow-calf operations, feeder cattle, and hogs, and for cash grains. The nonirrigated land is used mainly for alfalfa or grass for pasture or hay; in some areas, it is used for row crops and small grains. Most of the nonirrigated farmland is livestock oriented. On the irrigated land, corn, small grains, and alfalfa are the main crops. The water from wells is sufficient for livestock and domestic use.

The main concerns in managing the rangeland and cropland in this association are controlling soil blowing and conserving moisture. The low available water capacity is a limitation. On the cultivated land,

maintaining a cover of crop residue on the surface, stripcropping, minimum tillage, and applying fertilizer can help to control soil blowing, maintain fertility, and improve the water-holding capacity of the soils. On rangeland, water erosion is a hazard on the steeper soils. Proper stocking and a planned grazing system can help to control erosion and maintain or improve the vigor of rangeland grasses. Because many wells yield only 500 gallons of irrigation water per minute or less, good water management is necessary to avoid wasting this water.

On the average, the farms in this association are about 640 acres in size. The grain and livestock produced are sold at local markets or at the larger markets in Omaha and Sioux City. Gravel or improved dirt roads are along most section lines. Nebraska Highway 12 crosses the areas of this association.

14. Reliance-Ree-Jansen association

Nearly level to gently sloping, well drained silty and loamy soils that are deep or moderately deep over sand and gravel; these soils formed in silty loesslike material and loamy material

This association consists of nearly level to gently sloping soils on uplands. These soils formed in silty loess that was deposited over sand and gravel or shale.

This association makes up about 1 percent of the county. The land area is about 5,500 acres. Reliance soils make up about 19 percent of this association, Ree soils 15 percent, and Jansen soils 14 percent; Anselmo and Onita soils make up 12 percent each, and the other minor soils make up 28 percent.

Reliance soils are deep, gently sloping silty soils on convex ridges and side slopes. They are well drained and have moderately slow permeability. Typically, the surface layer is dark grayish brown, firm silt loam about 5 inches thick. The subsurface layer is very dark gray, firm silty loam about 6 inches thick. The subsoil extends to a depth of 37 inches; it is brown, firm silty clay loam. The underlying material, to a depth of about 48 inches, is brown silt loam; below that, to a depth of 60 inches, it is gravelly sand.

Ree soils are deep and have nearly level to very gently sloping loamy soils on broad plains. They are well drained and have moderate permeability. Typically, the surface soil is dark grayish brown, friable loam about 13 inches thick. The subsoil is grayish brown, firm clay loam

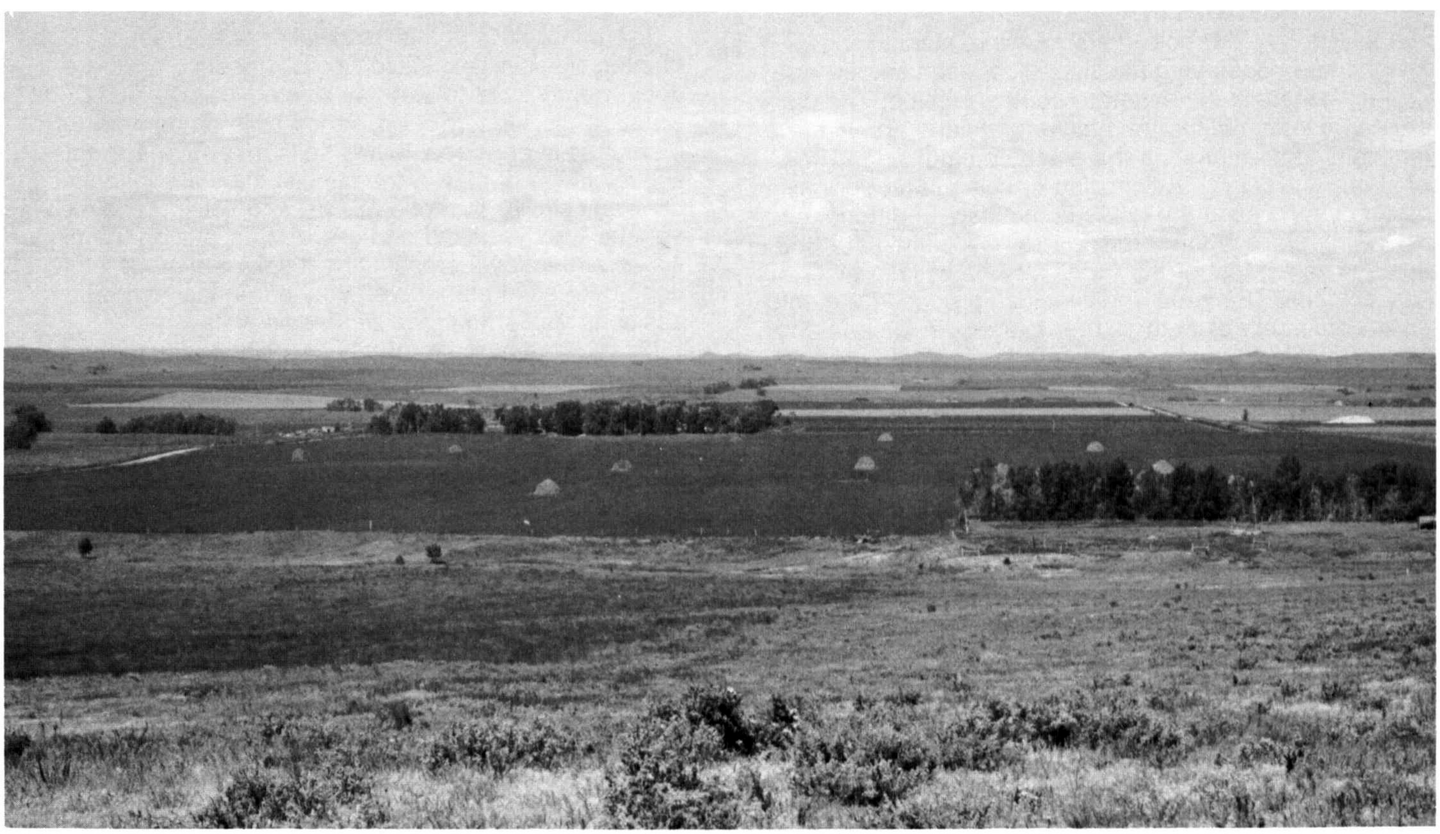


Figure 9.—An area of the Reliance-Ree-Jansen association. The alfalfa field and cropland are typical land uses.

about 12 inches thick. The underlying material, to a depth of 54 inches, is light brownish gray, friable clay loam; to a depth of 60 inches, it is loamy sand.

Jansen soils are nearly level to gently sloping well drained soils that are moderately deep over sand and gravel. Permeability is moderate in the surface layer and subsoil layer and very rapid on the underlying material. Typically, the surface layer is dark grayish brown, friable loam about 9 inches thick. The subsoil extends to a depth of 24 inches; it is grayish brown and brown, firm clay loam. The underlying material, to a depth of 27 inches, is light grayish brown loamy sand; below that, it is light gray gravelly sand.

The minor soils in this association are Anselmo, Onita, Brocksburg, Labu, O'Neill, and Wewela soils. Anselmo soils are deep, loamy soils on ridges that rise above the nearly level plain. Onita soils are deep, silty soils in swales. Brocksburg soils are level, loamy soils in the higher positions on the landscape; they are moderately deep over sand and gravel. Labu soils are clayey soils that are moderately deep over weathered shale; they are on rounded ridges and in areas near slope breaks. O'Neill soils are level and are moderately deep over sand and gravel. Wewela soils are moderately deep over shale; they are loamy in the upper part and clayey in the lower part. Wewela soils are on some of the rounded ridges and in areas adjacent to slope breaks.

Most of the acreage of this association is cropland (fig. 9). In a few areas, the soils are used as rangeland. The farms and ranches in this association are diversified, consisting of a combination of grain and livestock enterprises. They are used for producing livestock, including cow-calf operations, feeder cattle, and hogs, and for cash grains. The nonirrigated land is used mainly for alfalfa or grass for pasture or hay; in some areas, it is used for row crops and small grains. Most of the nonirrigated land is livestock oriented. On the irrigated land, corn, small grains, and alfalfa are the main crops. The water for irrigation generally is stored in large irrigation dams on the major drainageways. The wells in this association yield a very low amount of water.

The main concerns in managing the rangeland and cropland in this association are controlling soil blowing, conserving moisture, and maintaining or improving the fertility of the soils. The low available water capacity is a limitation. On cultivated land, maintaining a cover of crop residue on the surface, stripcropping, minimum tillage, and applying fertilizer can help to control soil blowing, maintain fertility, and improve the water-holding capacity of the soils. On rangeland, proper stocking and a planned grazing system can help to maintain or improve the vigor of the grasses.

On the average, the farms in this association are 640 acres in size. The grain and livestock produced generally are sold at local markets or at the larger markets in Omaha and Sioux City. Gravel or improved dirt roads are along some section lines and generally provide access to the farms or ranches. Nebraska Highway 12 crosses the areas of this association.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential for a soil for specific uses. They also can be used to plan the management needed for those uses. "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Anselmo fine sandy loam, 0 to 2 percent slopes, is one of several phases in the Anselmo series.

Some map units are made up of two or more soils in such an intricate pattern or in such small areas that they can cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Jansen-Meadin loams, 0 to 3 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

Table 4 gives the acrcage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

soil descriptions

Ab—Albaton Variant clay, 0 to 2 percent slopes. This is a deep, nearly level, poorly drained soil on bottom lands. This soil is subject to occasional flooding. The areas generally are elongated and range from 10 to 60 acres.

Typically, the surface layer is firm, calcareous, olive gray clay about 6 inches thick. The subsurface layer is very firm, calcareous, gray clay about 10 inches thick. The underlying material, to a depth of 40 inches, is gray and dark gray clay and dark gray clay loam; to a depth of 60 inches, it is light gray sand. In a few small areas, the surface layer is silty clay loam.

Included in mapping and making up 5 to 10 percent of this map unit are low marshy areas and small areas of sandy overwash adjacent to drainageways.

Permeability and runoff are slow. The available water capacity is moderate. The shrink-swell potential is high. The seasonal water table is at a depth of 1 foot in wet years and 3 feet in dry years. The soil is moderately alkaline. Tilth is poor.

This soil is used mainly as hayland. It has poor potential for cultivated crops and fair potential for trees and grain crops. This soil has fair potential for development of habitat for openland, rangeland, and wetland wildlife. It has poor potential for sanitary facilities, recreation uses, and building site development.

This soil is suited to dryfarmed grasses and legumes. Fertilizer needs to be applied to maintain a vigorous stand of grasses. This soil is poorly suited to cultivated crops because it is excessively wet in spring and is subject to occasional flooding. It is best suited to plants that are tolerant of wetness. Because of the high water table and the hazard of flooding, this soil is not suited to irrigation.

In some small areas, this soil is in native grasses and is used for grazing. Overgrazing causes deterioration of the plant community.

Windbreaks generally are not established on this soil. If windbreaks are needed, trees that can tolerate wetness should be used.

Because of wetness and the hazard of flooding, this soil is very poorly suited to use as septic tank absorption

fields, sewage lagoons, and sites for houses. This soil is poorly suited to use as a site for roads. Artificial drainage and elevated roadbeds are necessary in constructing roads on this soil. In some areas, the base material needs to be replaced to provide a moisture barrier against frost action.

The capability unit is IVw-1, dryland and irrigated; this soil is in the Clayey Overflow range site; it is in windbreak suitability group 2.

AmB—Anselmo loamy fine sand, 0 to 3 percent slopes. This is a deep, nearly level and gently undulating, well drained soil on uplands and stream terraces. The areas are slightly elongated and range from 10 to 100 acres.

Typically, the surface layer is very friable, dark grayish brown loamy fine sand about 10 inches thick. The subsurface layer is very friable, grayish brown loamy fine sand about 7 inches thick. The subsoil extends to a depth of 34 inches; it is grayish brown, very friable fine sandy loam. The underlying material is pale brown loamy fine sand. In some areas, this soil has a buried layer of loamy soil material. In some cultivated areas, the surface layer is partly eroded.

Included in mapping are areas of Dunday and O'Neill soils. Dunday soils are deep and sandy and O'Neill soils are moderately deep over gravelly sand. These soils are in positions on the landscape similar to those of this Anselmo soil but are more droughty than this soil. They make up 5 to 15 percent of this map unit.

Permeability is moderately rapid, and runoff is slow. The available water capacity is moderate. The organic matter content is low. Tilth is good. This soil is easy to till when it is moist.

About half the acreage is used for cultivated crops. A few small areas are in shelterbelts, and the rest is mainly rangeland. This soil has fair potential for dryfarmed or gravity-irrigated cultivated crops and for use as rangeland. It has good potential for crops if a sprinkler irrigation system is used. This soil has good potential for trees and shrubs in windbreaks, for the development of habitat for rangeland and openland wildlife, and for building site development. It has fair potential for recreation uses and poor potential for sewage lagoons. It has good potential for use as septic tank absorption fields.

This soil is suited to dryfarmed alfalfa, adapted grasses, and small grains. It is moderately well suited to corn and sorghum. This soil is highly susceptible to soil blowing and is droughty. Soil blowing can be reduced and moisture conserved by maintaining a cover of close-growing crops, grass, or crop residue on the surface. Stripcropping and field windbreaks also help to control soil blowing.

If this soil is irrigated, it is suited to corn, sorghum, small grains, and alfalfa. A sprinkler irrigation system, for example, the center-pivot sprinkler system, is the most suitable because it can provide the light, frequent applications of water needed on this soil. The same practices needed to control soil blowing in dryfarmed areas are needed on irrigated land.

Using this soil as rangeland is effective in controlling soil blowing and water erosion. Overgrazing the rangeland or using improper haying methods reduces the vegetative cover and causes deterioration of the plant community. Proper range use, deferred grazing or haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil is suited to most trees in windbreaks. Site preparation and timely cultivation can increase seedling survival, reduce plant competition, and speed the growth of the limitations trees. The low rainfall and the hazard of soil blowing are limitations to planting trees on this soil. Soil blowing can be reduced by planting a cover crop between the rows of trees.

This soil is suitable for use as septic tank absorption fields and as sites for houses and local roads and streets. Seepage is a severe limitation to use as sewage lagoons and as sites for sanitary landfill. This limitation can be overcome by sealing the bottom with less permeable material.

The capability unit is IIIe-5, dryland, and IIIe-10, irrigated; this soil is in the Sandy range site; it is in windbreak suitability group 3.

An—Anselmo fine sandy loam, 0 to 2 percent slopes. This is a deep, nearly level, well drained soil on uplands and stream terraces. The areas generally are somewhat elongated and range from 5 to 100 acres.

Typically, the surface layer is very friable, grayish brown fine sandy loam about 5 inches thick. The subsurface layer is very friable, dark grayish brown fine sandy loam about 8 inches thick. The subsoil extends to a depth of 24 inches; it is very friable, grayish brown fine sandy loam. The underlying material, to a depth of 40 inches, is brown fine sand; below that, it is pale brown sand. In a few areas, some of the original surface layer has been shifted by soil blowing. In some areas, layers of loam, fine sandy loam, and coarse sand are in the underlying material.

Included in mapping are small areas of Dunday and Holt soils. Dunday soils are more sandy than this Anselmo soil and generally are in higher positions on the landscape. Holt soils are in the same landscape position as the Anselmo soil; however, they have sandstone at a depth of less than 40 inches. The included soils make up 5 to 10 percent of this map unit.

Permeability is moderately rapid. Runoff is slow. The available water capacity is moderate. The organic matter content is moderately low. Tilth is good, and the soil is easy to till within a wide range in moisture content.

About 75 percent of the acreage is used for cultivated crops. The rest is mainly used as rangeland. This soil has good potential for the commonly grown cultivated crops, either dryfarmed or irrigated. It has fair potential for use as rangeland and good potential for trees and

shrubs in windbreaks. This soil has good potential for recreation uses and for the development of habitat for rangeland and openland wildlife. It has good potential for use as septic tank absorption fields and for building site development and poor potential for sewage lagoons.

This soil is suited to dryfarmed corn, alfalfa, small grains, and grasses and legumes. Soil blowing is a moderate hazard, and water erosion is a slight hazard. This soil is droughty in years of below average rainfall. Conservation tillage that leaves crop residue on the surface, contour farming, stripcropping, and field windbreaks help to control erosion and conserve moisture.

If this soil is irrigated, it is suited to most of the crops commonly grown in the county. A sprinkler irrigation system, for example, the center-pivot sprinkler system, generally is the most suitable because it provides the light, frequent applications of water needed on this soil. A gravity irrigation system is also suitable; however, some land leveling will be necessary. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

This soil is well suited to use as rangeland. Using this soil as rangeland is effective in controlling soil blowing and water erosion. However, overgrazing the rangeland or using improper haying methods reduces the vegetative cover, causes deterioration of the plant community, increases soil blowing, and creates small blowouts. Proper range use, deferred grazing and haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil is suited to trees in windbreaks if soil blowing is controlled by maintaining a strip of sod or other vegetation between the rows of trees. Droughtiness and competition from grasses and weeds for moisture are hazards. Only trees and shrubs that are tolerant of the slightly sandy, somewhat droughty condition of this soil are suitable.

This soil is well suited to use as sites for houses and septic tank absorption fields. Unless the bottom of sewage lagoons is sealed, seepage is a problem. Because this soil is susceptible to frost heave it has only fair suitability for local roads and streets.

The capability unit is IIe-3, dryland, and IIe-8, irrigated; this soil is in the Sandy range site; it is in windbreak suitability group 3.

AnC—Anselmo fine sandy loam, 2 to 6 percent slopes. This is a deep, gently sloping, well drained soil on uplands and on some stream terraces. The areas generally are irregular in shape and range from 5 to 100 acres.

Typically, the surface layer is very friable, grayish brown fine sandy loam about 6 inches thick. The subsurface layer is very friable, dark grayish brown fine sandy loam about 10 inches thick. The subsoil extends to a depth of 22 inches; it is very friable, grayish brown fine sandy loam. The underlying material, to a depth of 44 inches, is pale brown fine sandy loam; below that, it is light gray loamy fine sand. In a few areas, the original surface layer has been shifted by soil blowing. In places, the surface layer is loamy fine sand. In some areas, layers of coarser and finer textured material are in the underlying material.

Included in mapping are small areas of Dunday and Holt soils. Dunday soils are more sandy than this Anselmo soil and generally are in higher positions on the landscape. Holt soils are in landscape positions similar to those of this soil; however, they have sandstone at a depth of less than 40 inches. The included soils make up 5 to 10 percent of this map unit.

Permeability is moderately rapid. Runoff is slow. The available water capacity is moderate. The organic matter content is moderately low. Tilth is good, and the soil is easy to till within a wide range in moisture content.

About 75 percent of the acreage is used for cultivated crops. The rest is used mainly as rangeland. This soil has fair potential for the commonly grown cultivated crops, either dryfarmed or irrigated using a sprinkler system. The potential for crops is poor if a gravity irrigation system is used. This soil has fair potential for use as rangeland and good potential for trees and shrubs in windbreaks. It has good potential for recreation uses and for the development of habitat for rangeland and openland wildlife. This soil has good potential for use as septic tank absorption fields and for building site development and poor potential for sewage lagoons.

This soil is suited to dryfarmed corn, alfalfa, small grains, and grasses and legumes. Soil blowing is a moderate hazard, and water erosion is a slight hazard. This soil is droughty in years of below average rainfall. Conservation tillage that leaves crop residue on the surface, contour farming, stripcropping, and field windbreaks help to control erosion and conserve moisture.

If this soil is irrigated it is suited to most of the crops commonly grown in the county. A sprinkler irrigation system, for example, the center-pivot sprinkler system, generally is the most suitable because it provides the light, frequent applications of water needed on this soil. It does not require land leveling. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

This soil is well suited to use as rangeland. Using this soil as rangeland is effective in controlling soil blowing and water erosion. However, overgrazing the rangeland or using improper haying methods reduces the vegetative cover, causes deterioration of the plant community, increases soil blowing, and creates small blowouts. Proper range use, deferred grazing and haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil is suited to trees in windbreaks if soil blowing is controlled by maintaining a strip of sod or other vegetation between the rows of trees. Droughtiness and competition from grasses and weeds for moisture are

hazards to tree survival. Only trees and shrubs that are tolerant of the slightly sandy, somewhat droughty condition of this soil are suitable.

This soil is well suited to use as sites for houses and as septic tank absorption fields. Unless the bottom of sewage lagoons is sealed, seepage is a problem. Because this soil is susceptible to frost heave, it has only fair suitability for local roads and streets.

The capability unit is IIIe-3, dryland, and IIIe-8, irrigated; this soil is in the Sandy range site; it is in windbreak suitability group 3.

Ba—Barney fine sandy loam, 0 to 2 percent slopes. This is a nearly level, poorly drained soil on bottom lands of the major streams. This soil is frequently flooded. The areas range from 5 to 80 acres.

Typically, the surface layer is very friable, gray fine sandy loam about 7 inches thick. In general, a 1/2- to 1-inch thick layer of partly decomposed leaves and stems overlies the surface layer. The underlying material, to a depth of about 30 inches, is light gray fine sand that has yellowish brown mottles; below that, it is light gray sand. In some places, the surface layer is loamy fine sand.

Included in mapping are small areas of Boel, Els, Inavale, Loup, and Ord soils. Boel, Els, Inavale, and Ord soils have better drainage than the Barney soil. Loup and Ord soils have a darker and thicker surface layer. Boel, Els, and Ord soils are in slightly higher positions on the landscape. Inavale soils generally are closer to the stream channel than the Barney soil. Loup soils are in the same landscape positions as the Barney soil. The included soils make up 5 to 15 percent of this map unit.

Permeability is rapid. Runoff is very slow. The available water capacity is low. The organic matter content is moderate. The seasonal water table is at the surface or within a depth of 2 feet. This soil is frequently flooded early in spring, when the streamflow is highest.

In most areas, this soil is used as rangeland or hayland. It has very poor potential for cultivated crops. It has good potential for adapted rangeland grasses. This soil has poor potential for trees in windbreaks, recreation uses, sanitary facilities, and building site development. It has fair potential for use as pasture and for the development of habitat for rangeland wildlife and good potential for the development of habitat for wetland wildlife.

This soil is not suited to cultivated crops because of wetness and the moderate depth to sand and gravel.

Using this soil as rangeland is effective in controlling soil blowing. Overgrazing the rangeland or using improper haying methods reduces the vegetative cover and causes deterioration of the plant community. When the soil is wet, overgrazing causes surface compaction and causes bogs or small mounds to form, which make grazing or harvesting for hay difficult. Proper range use, deferred grazing or haying, and restricted use during very wet periods help to maintain the plant community and the soil in good condition.

This soil can be used for livestock-protection windbreaks and wildlife plantings. Only trees and shrubs that can tolerate the very high water table of this soil are suitable. Establishing trees in wet years is difficult; special methods of planting may be necessary to prevent seedlings from drowning.

This soil is severely limited for sanitary facilities and building site development because of wetness caused by the high water table and the frequent flooding. If roads or streets need to be built on this soil, artificial drainage, elevated roadbeds, and a modified base material can help to overcome the wetness limitation. Ponds can be established on this soil as a source of water for livestock and wildlife. This soil is good source of sand. It is too wet for most recreation uses.

The capability unit is Vw-7, dryland; this soil is in the Wetland range site; it is in windbreak suitability group 6.

Bo—Boel fine sandy loam, 0 to 2 percent slopes. This is a deep, nearly level, somewhat poorly drained soil on bottom lands. This soil is occasionally flooded. The areas generally are elongated and range from 5 to 160 acres.

Typically, the surface layer is friable, dark grayish brown fine sandy loam about 7 inches thick. The layer below that is friable, dark grayish brown loamy sand about 8 inches thick. The underlying material, to a depth of 60 inches, is light gray sand; below a depth of 24 inches, it has yellowish red mottles. In places, the surface layer is silt loam, loam, or loamy fine sand. The underlying material commonly has a layer of dark loamy material.

Included in mapping are small areas of sand overblow. Also included are small areas of Barney, Els, Inavale, and Loup soils. Barney soils are poorly drained and are in slightly lower landscape positions than this Boel soil. Els soils are in slightly raised positions. Inavale soils are somewhat excessively drained; they are adjacent to entrenched channels or in slightly raised positions. Loup soils are poorly drained; they are in swales and in very shallow channels. These inclusions make up 10 to 25 percent of this map unit.

Permeability is rapid. Runoff is very slow. The available water capacity is low to moderate above the water table. Tilth is good, but the surface layer is too wet for cultivation in some periods of the year. The soil ranges from neutral to moderately alkaline. The seasonal water table is at a depth of 1.5 to 3.5 feet. In areas where this soil has a high content of lime, the soil responds poorly to applications of phosphate fertilizer.

In most areas, this soil is in native grassland that has scattered deciduous trees; in these areas, it is used as range or hayland. This soil has fair potential for the cultivated crops commonly grown in the county and for trees in windbreaks. It has good potential for the development of habitat for openland or rangeland wildlife. This soil has poor potential for sanitary facilities and building site development. It has fair to poor potential for recreation uses.

This soil is suited to dryfarmed corn, sorghum, small grains, and tame grasses. It is suited to alfalfa in areas where the water table is not too high. Wetness generally delays tillage and cultivation early in spring. Growing alfalfa and crops that are seeded in the fall eliminates the need for working this soil in spring. If this soil is cultivated, soil blowing can be reduced through the use of stubble-mulch tillage and a cropping system that maintains a cover of crop residue on the surface. Returning crop residue to the soil helps to maintain or improve the organic matter content.

If this soil is irrigated, it is suited to corn, sorghum, and alfalfa. A sprinkler irrigation system, for example the center-pivot sprinkler system, is the most suitable because it can provide the light, frequent applications of water needed on this soil. Excessive irrigation leaches plant nutrients below the root zone. Diversions, drainage ditches, or tile drains help to control wetness and to lower the water table. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

This soil is suited to trees in windbreaks. Only trees and shrubs that can tolerate the high water table of this soil are suitable. In some years, establishing tree seedlings and cover crops between the rows of trees is difficult because of excessive wetness.

This soil is severely limited for use as septic tank absorption fields and sewage lagoons because of wetness caused by the high water table. Septic tank absorption fields do not function properly in wet periods. Sewage lagoons need to be lined or sealed. Wetness also is a severe limitation for shallow excavations, houses, and local roads and streets. Excavations in this soil should be made in dry periods. If this soil is used as building sites, artificial drainage, footing drains, and basement sump pumps can help to reduce or overcome the wetness limitation. If this soil is used for roads, the roadbed should be raised or the roads routed to bypass wet areas. The occasional flooding and wetness are limitations to recreational development.

The capability unit is IIIw-6, dryland, and IIIw-11, irrigated; this soil is in the Subirrigated range site; it is in windbreak suitability group 2.

Bt—Brocksburg loam, 0 to 1 percent slopes. This is a well drained, nearly level soil on broad tablelands. It is moderately deep over sand and gravel. The areas of this soil range from 10 to 400 acres.

Typically, the surface soil is a friable, very dark grayish brown loam about 15 inches thick. The subsoil extends to a depth of 27 inches; it is grayish brown and dark grayish brown, firm clay loam. The underlying material, to a depth of 30 inches, is brown loam; below that, it is pale brown gravelly sand. Where this soil has been cultivated, the plow layer is grayish brown and has been winnowed, resulting in the loss of some of the finer soil particles and organic matter. In a few places, the sand and gravel are at a depth of more than 40 inches.

Included in mapping are small areas of Meadin and O'Neill soils. Meadin soils are shallow over sand and gravel and are in slightly lower positions on the landscape. O'Neill soils are more sandy than the Brocksburg soil and are slightly higher on the landscape. Both of the included soils are more droughty than the Brocksburg soil and are more susceptible to soil blowing. Also included are a few small potholes. Water standing in these potholes interferes with cultivation. The included areas make up 5 to 10 percent of the map unit.

The surface layer is easy to till within a fairly wide range in moisture content. Runoff is slow because this soil is nearly level. Permeability is moderate in the subsoil and very rapid in the underlying sand and gravel. The available water capacity is moderate. The organic matter content is moderate. The root zone of most plants is restricted by sand and gravel at a depth of 20 to 40 inches. The soil generally is neutral throughout; in some areas, the layer just above the sand and gravel is mildly alkaline.

Most of the acreage is cultivated. In a few areas, this soil is in native grass and is used for grazing or hay. This soil has fair potential for dryfarmed cultivated crops. It has good potential for crops if an irrigation system is used. This soil has fair potential for use as rangeland, for trees in windbreaks, and for the development of habitat for rangeland wildlife. It has good potential for recreation uses and for the development of habitat for openland wildlife. This soil has poor potential for most sanitary facilities and fair potential for building site development.

This soil is suited to dryfarmed corn, sorghum, wheat, oats, grasses, and legumes. If this soil is used for cultivated crops, soil blowing is a hazard, and production is limited because the moisture supply is inadequate. Minimum tillage, stripcropping, and stubble-mulch tillage help to prevent soil blowing and conserve moisture.

If this soil is irrigated, it is well suited to corn, sorghum, and alfalfa. Where land leveling is feasible, a furrow or border irrigation system is effective. The cuts should not be so deep that the coarse underlying material is exposed. A sprinkler irrigation system also is suitable. Because of the very low moisture-retention capacity of the underlying material, droughtiness is a hazard unless irrigation is timely. The application of water must be carefully managed to prevent the leaching of plant nutrients from the soil. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

If this soil is used as native rangeland, proper range use, deferred grazing, and a planned grazing system are necessary to maintain a vigorous stand of grass. Livestock distribution on rangeland can be improved by fencing and by placing water and salt for livestock in strategic locations. Overgrazing the rangeland reduces the grass cover and causes deterioration of the plant community.

This soil has fair suitability for trees in windbreaks. Only drought-tolerant trees and shrubs are suitable for

planting. Droughtiness and competition from grass and weeds for moisture are the main limitations to seedling establishment.

This soil has fair suitability for use as sites for houses. It has excellent bearing strength if the footings of the foundation are placed in the underlying sand and gravel. Because the material above the sand and gravel has moderate shrink-swell potential, this material should not be used for backfill or as a footing base. Because the permeability of the sand and gravel is very rapid, ground water can be polluted if this soil is used as septic tank absorption fields or for sewage lagoons. The bottom of sewage lagoons needs to be lined to prevent seepage. Shrinking and swelling and frost action are limitations tc the use of this soil as a site for roads and streets; the limitations can be overcome through surface drainage.

The capability unit is IIs-5, dryland, and IIs-7, irrigated; this soil is in the Silty range site; it is in windbreak suitability group 5.

Cb—Cass loam, 0 to 2 percent slopes. This is a deep, nearly level, well drained soil on bottom lands. In some areas, this soil is adjacent to the streams, and in others, it is on the higher bottom lands near the uplands. This soil is rarely flooded. The areas are irregular in shape and range from 5 to 50 acres.

Typically, the surface layer is friable, dark grayish brown loam about 10 inches thick. The layer below that is very friable, grayish brown fine sandy loam about 4 inches thick. The underlying material, to a depth of 20 inches, is pale brown very fine sandy loam. It is underlain by a buried layer of dark gray fine sandy loam about 20 inches thick. Below that, to a depth of 60 inches, the soil is light brownish gray loamy fine sand. In some areas, free carbonates are below a depth of 25 inches. In places, the surface layer is fine sandy loam. In some areas, there is no buried layer in the underlying material.

Included in mapping are small areas of Boel, Inavale, and Munjor soils. Boel soils are somewhat poorly drained and are in the lower areas. Inavale soils are sandy and have a thin surface layer; they are nearer to the stream channel than the Cass soil. Munjor soils are calcareous and have a thinner and lighter colored surface layer than the Cass soil. Their position on the landscape is similar to that of the Cass soil. The included soils make up 5 to 15 percent of this map unit.

Permeability is moderately rapid, and runoff is slow. The available water capacity is moderate. Tilth is good, and the soil can be worked within a fairly wide range in moisture content. The organic matter content is moderately low.

About 75 percent of the acreage is used for cultivated crops. The rest is mainly grassland that has some scattered deciduous trees. This soil has good potential for cultivated crops, either dryfarmed or irrigated. It also has good potential for use as rangeland or pasture, for trees in windbreaks, and for the development of habitat for rangeland, openland, and woodland wildlife. This soil has good potential for all recreation uses except camp areas. It has poor potential for sanitary facilities and building site development.

This soil is well suited to dryfarmed corn, small grains, and grasses and legumes for hay and pasture. Droughtiness due to the underlying material is a limitation for crops, particularly in years in below average rainfall. Soil blowing is a moderate hazard if the soil is bare of vegetation. Conservation tillage that keeps crop residue on the surface or a cropping system that maintains a cover of legumes or grasses or both helps to maintain or improve the organic matter content, to maintain fertility, and to control soil blowing.

If this soil is irrigated, it is best suited to corn and alfalfa; small grains or tame grasses also can be grown. A gravity or sprinkler system of irrigation is suitable on this soil. If a gravity system is used, land leveling will be necessary for best results. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

Using this soil as rangeland is effective in controlling soil blowing and water erosion. Overgrazing the rangeland or using improper haying methods reduces the vegetative cover and causes deterioration of the plant community. Proper range use and deferred grazing or haying help to maintain or improve the condition of the rangeland and the soil.

This soil provides good sites for trees and shrubs in field windbreaks, in range or livestock windbreaks, and in recreation or wildlife plantings. Only trees and shrubs that can tolerate the slightly sandy, somewhat droughty condition of this soil are suitable. Droughtiness and the severe hazard of soil blowing are the main limitations to establishing trees. Soil blowing can be controlled by maintaining a strip of sod or other vegetation between the rows of trees. Cultivation should be restricted to the tree rows.

The hazard of flooding is a limitation to the use of this soil for building site development and most sanitary facilities. Dikes, diversions, or ditches can be used to help overcome this limitation. If these structures cannot be built, sites at higher elevations should be selected for buildings and sanitary facilities. This soil is suited to use as septic tank absorption fields; however, seepage from the fields can pollute local well water. If this soil is used for sewage lagoons, the bottom needs to be lined with less permeable soil material, chemical sealers, or impervious liners to prevent seepage. Low soil strength and frost action are limitations to the use of this soil as sites for roads and streets. Replacing the base material, elevating the roadbed, and constructing dikes, diversions, or ditches can help to overcome these limitations. This soil is suited to most recreation uses. It is not suited to camp areas because flooding is a severe hazard.

The capability unit is I-1, dryland, and I-8, irrigated; this soil is in the Sandy Lowland range site; it is in windbreak suitability group 1.

CcB—Cass loam, channeled, 0 to 3 percent slopes. This is a deep, well drained soil on flood plains and terraces. It is subject to frequent flooding. The landscape is dissected by channels that meander across the flood plain. The channels are 12 to 30 feet wide and 5 to 10 feet deep. Slopes generally are less than 3 percent, but they are as much as 7 percent on some of the narrow benches and streambanks. The areas are long and narrow and range from 5 to 30 acres.

Typically, the surface layer is firm, dark grayish brown loam about 6 inches thick. The layer below that is friable, grayish brown loam about 14 inches thick. The underlying material, to a depth of 60 inches, is stratified, calcareous silt, sand, gravel, and clay; the soil is dominantly light brownish gray, but some strata are darker or lighter in color. In some areas, the surface layer is fine sandy loam or clay loam.

Included in mapping are areas of Inavale, Labu, Munjor, Ord, Verdel, and Wewela soils. Inavale soils are sandy and are adjacent to the channel. Labu soils are moderately deep, clayey soils on the slope breaks between the stream terraces and bottom lands. Munjor soils are calcareous and have a thinner and lighter colored surface layer than the Cass soil. Ther are in similar positions on the landscape. Ord soils are loamy, somewhat poorly drained soils on the lower part of the valley floor. Verdel soils are deep and clayey; they are in positions on the landscape similar to those of this Cass soil. Wewela soils have a sandy surface layer and are moderately deep over shale; they are on the stream terraces. The included soils make up 30 to 35 percent of this map unit.

Permeability is moderately rapid, and runoff is slow. The available water capacity is moderate. The organic matter content is moderately low. The seasonal water table generally is below a depth of 6 feet.

This soil is used mainly as rangeland; the rangeland has been invaded by deciduous trees and other woody plants. This soil has poor potential for cultivated crops, windbreaks, and most recreation uses. It has fair to good potential for use as pasture or rangeland if the trees and shrubs are cleared. This soil has fair potential for the development of habitat for rangeland, openland, and woodland wildlife. It has poor potential for sanitary facilities and building site development.

This soil is not suitable for cultivated crops because of the frequent overflow, the streambank cutting, and the meandering of the channel.

Using this soil as rangeland is effective in controlling water erosion and soil blowing. The overgrazing of rangeland and the deposition of silt by floodwaters reduce the vegetative cover and cause deterioration of the plant community. Proper range use and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil is not suited to windbreaks. In some areas, adapted trees or shrubs can be used for wildlife or forestation plantings if they are planted by hand.

This soil is not suited to building site development or sanitary facilities. Access roads and fences are subject to damage by the meandering of the channel and the streambank cutting. If this soil is used as a site for roads, special structures generally are required. This soil is not suited to most recreation uses. In some places, pond reservoirs can be established.

The capability unit is VIw-7, dryland; this soil is in the Sandy Lowland range site; it is in windbreak suitability group 10.

DdB—Duda loamy fine sand, 0 to 3 percent slopes. This is a moderately deep, nearly level and very gently sloping, well drained soil on low-lying side slopes and divides of upland drainageways. The areas are irregular in shape and range from 5 to 50 acres.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 6 inches thick. The layer below that is grayish brown, very friable loamy fine sand about 6 inches thick. The underlying material is light gray loamy fine sand that has some fragments of light gray sandstone. Hard, calcareous sandstone is at a depth of 30 inches. In some areas, the surface layer is sandy loam.

Included in mapping are small areas of Dunday, Tassel, and Valentine soils. Dunday soils are in positions on the landscape similar to those of this Duda soil, but they are deeper and have a thicker surface layer. Tassel soils are shallow and are in higher flat areas or in swales. Valentine soils are deep and are in higher positions than this Duda soil. The included soils make up 10 to 15 percent of this map unit.

The surface layer is very friable and is easy to till within a wide range in moisture content. Runoff is slow because moisture is readily absorbed by the soil. Permeability is moderately rapid. The available water capacity is low. The organic matter content is low. The root zone generally is restricted by sandstone; however, some roots can penetrate cracks in the sandstone. The soil is neutral in the surface layer and mildly alkaline in the underlying material.

In most areas, this soil is in native grass and is used for hay or grazing. In some areas, it is used for dryfarmed alfalfa that is grown for hay. In a few areas, it is used for cultivated crops; most of this cropland is irrigated. This soil has poor potential for use as dryfarmed or gravity-irrigated cropland. It has fair potential for crops if a sprinkler irrigation is used. This soil has fair potential for recreation uses, for the development of habitat for rangeland and openland wildlife, and for use as pasture or rangeland. This soil has good potential for trees in windbreaks and for use as sites for roads and streets. It has poor potential for sanitary facilities and good to fair potential for use as sites for houses.

This soil is only marginally suited to dryfarmed row crops. It is best suited to close-growing crops such as alfalfa and grass. If this soil is cultivated, soil blowing is a

moderate to severe hazard. The low fertility and low available water capacity of this soil are limitations to cultivated crops. A cropping system that leaves crop residue on the surface can protect the soil from soil blowing and improve the organic matter content of the soil. Narrow windbreaks can also help to reduce soil blowing.

If this soil is irrigated, it is suited to alfalfa, pasture grasses, and close-growing crops. This soil is suited only to sprinkler irrigation. It is especially well suited to a center-pivot system. A large amount of crop residue on the surface, stripcropping, field windbreaks, minimum tillage, and fertilizer help to control soil blowing and maintain fertility.

Using this soil as rangeland is effective in controlling soil blowing. However, overgrazing the rangeland or using improper haying methods reduces the vegetative cover, causes deterioration of the plant community, increases soil blowing, and creates blowouts. Proper range use, deferred grazing or haying, and a planned grazing systems help to maintain or improve the condition of the rangeland and the soil. The small blowouts on this soil can be fenced to exclude livestock and then stabilized by mulching and reseeding.

This soil is poorly suited to sanitary facilities because of the moderate depth to sandstone and the hazard of seepage. Depending on the hardness of the sandstone and the depth to sandstone, percolation can be a problem in septic tank absorption fields. Lateral seepage of wastes above the sandstone can cause contamination of well water. If this soil is used for sewage lagoons, the bottom will need to be lined with less permeable soil material or sealed with a chemical sealer to prevent seepage. This soil is limited for building site development by the tendency of embankments to cave in and by the moderate depth to sandstone. A suitable material will be needed for back fill or landscaping if this soil is used as a building site. The sandy texture of the surface layer and soil blowing are moderate limitations to camp areas, playgrounds, and trails. If local streets and roads are constructed on this soil, soil blowing can cause problems, and banks and ditches will need to be revegetated.

The capability unit is IVe-5, dryland, and IVe-14, irrigated; this soil is in the Sandy range site; it is in windbreak suitability group 3.

DdC—Duda loamy fine sand, 3 to 6 percent slopes. This is a moderately deep, gently sloping or undulating, well drained soil on uplands. The areas are irregular in shape and range from 3 to 60 acres.

Typically, the surface layer is very friable, dark grayish brown loamy fine sand about 6 inches thick. The layer below that is grayish brown, very friable loamy fine sand about 12 inches thick. The underlying material is light olive gray and light gray loamy fine sand. Sandstone is at a depth of 30 inches. In some places, a layer of fine sand overlies the sandstone.

Included in mapping are small areas of Dunday, Tassel, and Valentine soils. Dunday soils are in positions on the landscape similar to those of this Duda soil, but they are deeper and have a thicker surface layer. Tassel soils are droughty, shallow soils in higher flat areas and swales. Valentine soils are deeper than this soil and are in higher landscape positions. The included soils make up 10 to 15 percent of this map unit.

Runoff is slow because moisture is readily absorbed by the soil. Permeability is moderately rapid, and the available water capacity is low. The organic matter content is low. The root zone generally is restricted by sandstone; however, some roots can penetrate cracks in the sandstone. The soil is neutral in the surface layer and mildly alkaline in the underlying material.

In most areas, this soil is in native grass and is used for hay or grazing. In some areas, it is used for dryfarmed alfalfa that is grown for hay. In a few areas, this soil is used for cultivated crops. Most of this cropland is irrigated. This soil has very poor potential for use as dryfarmed or gravity-irrigated cropland. It has fair potential for use as sprinkler-irrigated cropland, for recreation uses, for use as pasture or rangeland, for trees in windbreaks, and for the development of habitat for rangeland and openland wildlife. This soil has good potential for use as sites for roads and streets, poor potential for sanitary facilities, and good to fair potential for building site development.

This soil is only marginally suited to dryfarmed row crops. It is best suited to close-growing crops such as alfalfa and grass. If this soil is cultivated, soil blowing is a moderate to severe hazard. Droughtiness due to the underlying material and low fertility are limitations to use as cropland. The soil commonly is loose and is difficult to work. Crop residue on the surface can reduce soil blowing and improve the organic matter content of the soil. Narrow windbreaks also help to reduce soil blowing.

If this soil is irrigated, it is suited to alfalfa, pasture grasses, and close-growing crops. This soil is suited to sprinkler irrigation only. It is especially well suited to a center-pivot system. A large amount of crop residue on the surface, stripcropping, field windbreaks, minimum tillage, and fertilizer help to control soil blowing and maintain fertility.

Using this soil as rangeland is effective in controlling soil blowing. However, overgrazing the rangeland or using improper haying methods reduces the vegetative cover, causes deterioration of the plant community, increases soil blowing, and creates blowouts. Proper range use, deferred grazing or haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil. The small blowouts on this soil can be fenced to exclude livestock and then converted to rangeland by mulching and reseeding.

This soil is poorly suited to sanitary facilities because of the moderate depth to sandstone and the hazard of seepage. Depending on the hardness of the sandstone and the depth to sandstone, percolation can be a

problem in septic tank absorption fields. Lateral seepage of wastes above the sandstone can cause contamination of well water. If this soil is used for sewage lagoons, the bottom will need to be sealed with less permeable soil material or sealed with a chemical sealer to prevent seepage. This soil is limited for building site developments by the tendency of embankments to cave in and by the moderate depth to sandstone. A suitable material will be needed for backfill or landscaping if this soil is used as a building site. The sandy texture of the surface layer and soil blowing are moderate limitations to camp areas, playgrounds, and trails. If local streets and roads are built on this soil, soil blowing can cause problems, and banks and ditches will need to be revegetated.

The capability unit is VIe-5, dryland, and IVe-14, irrigated; this soil is in the Sandy range site; it is in windbreak suitability group 7.

DuB—Dunday loamy fine sand, 0 to 3 percent slopes. This is a deep, nearly level to very gently sloping, well drained soil on uplands. The areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is dark gray, very friable loamy fine sand about 9 inches thick. The subsurface layer is dark grayish brown, very friable loamy fine sand about 6 inches thick. The layer below that is grayish brown, loose, loamy fine sand about 14 inches thick. The underlying material, to a depth of 60 inches, is brown loamy fine sand. In some places, the soil is dark colored to a depth of less than 10 inches, and in others, to a depth of more than 20 inches. In some areas, the surface layer is fine sandy loam or fine sand.

Included in mapping are small areas of Duda, Elsmere, and O'Neill soils. Duda soils have a thinner surface layer than this Dunday soil and are moderately deep over sandstone. Their position on the landscape is similar to that of the Dunday soil. Elsmere soils are somewhat poorly drained and are in swales. O'Neill soils are in slightly raised areas and have sand and gravel at a depth of less than 40 inches. The included soils make up 5 to 20 percent of this map unit.

Permeability is rapid. Runoff is very slow. The available water capacity is low. The organic matter content is moderately low. This soil is easy to work when it is moist but generally is loose when it is dry.

About half the acreage is used for hay and as pasture. The rest is used about equally for cultivated crops and as rangeland. In a few small areas, it is used for windbreaks. This soil has fair potential for use as rangeland, hayland, and pasture and poor potential for dryfarmed cultivated crops. It has good potential for crops if a sprinkler irrigation system is used and fair potential if a gravity irrigation system is used. This soil has good potential for trees in windbreaks and for the development of habitat for openland and rangeland wildlife. It has fair potential for recreation uses. This soil has good potential for use as sites for roads and houses. It has poor potential for sewage lagoons and good potential for septic tank absorption fields.

This soil is only marginally suited to dryfarmed row crops. It is best suited to close-growing crops such as alfalfa and grass. If this soil is cultivated, soil blowing is a moderate to severe hazard. Droughtiness due to the underlying material and low fertility are limitations to use as dryfarmed cropland. A cropping system that leaves crop residue on the surface can reduce soil blowing and improve the organic matter content of the soil. Narrow windbreaks also help to reduce soil blowing.

If this soil is irrigated, it is suited to alfalfa, pasture grasses, close-growing crops, corn, and sorghum (fig. 10). The only irrigation system suitable on this soil is the sprinkler system. This soil is especially well suited to the center-pivot system of sprinkler irrigation. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

Using this soil as rangeland is effective in controlling soil blowing and water erosion. Overgrazing the rangeland or using improper haying methods reduces the vegetative cover and causes deterioration of the plant community. Proper range use, deferred grazing or haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil is suited to most trees in windbreaks. Site preparation and cultivation to control weeds can increase the survival of trees and the rate of growth. Inadequate precipitation and the hazard of soil blowing are limitations to establishing trees. Soil blowing can be reduced by planting a cover crop between the rows of trees.

This soil has slight limitations for use as sites for houses, septic tank absorption fields, and roads and streets. It is severely limited for sewage lagoons because of seepage. It is severely limited for shallow excavations because cutbanks tend to cave in. This soil is moderately limited for camp areas and picnic areas because maintaining a cover of vegetation on this sandy soil is difficult.

The capability unit is IVe-5, dryland, and IIIe-11, irrigated; this soil is in the Sandy range site; it is in windbreak suitability group 3.

DxB—Dunday-Duda loamy fine sands, 0 to 3 percent slopes. This map unit consists of nearly level to very gently sloping, well drained soils on uplands. The areas of this unit range from 5 to 80 acres. The Dunday and Duda soils are about equal in extent; they are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Dunday soil is loose, grayish brown loamy fine sand about 6 inches thick. The subsurface layer is very friable, dark gray loamy fine sand about 10 inches thick. The layer below that is grayish brown and light brownish gray, very friable loamy

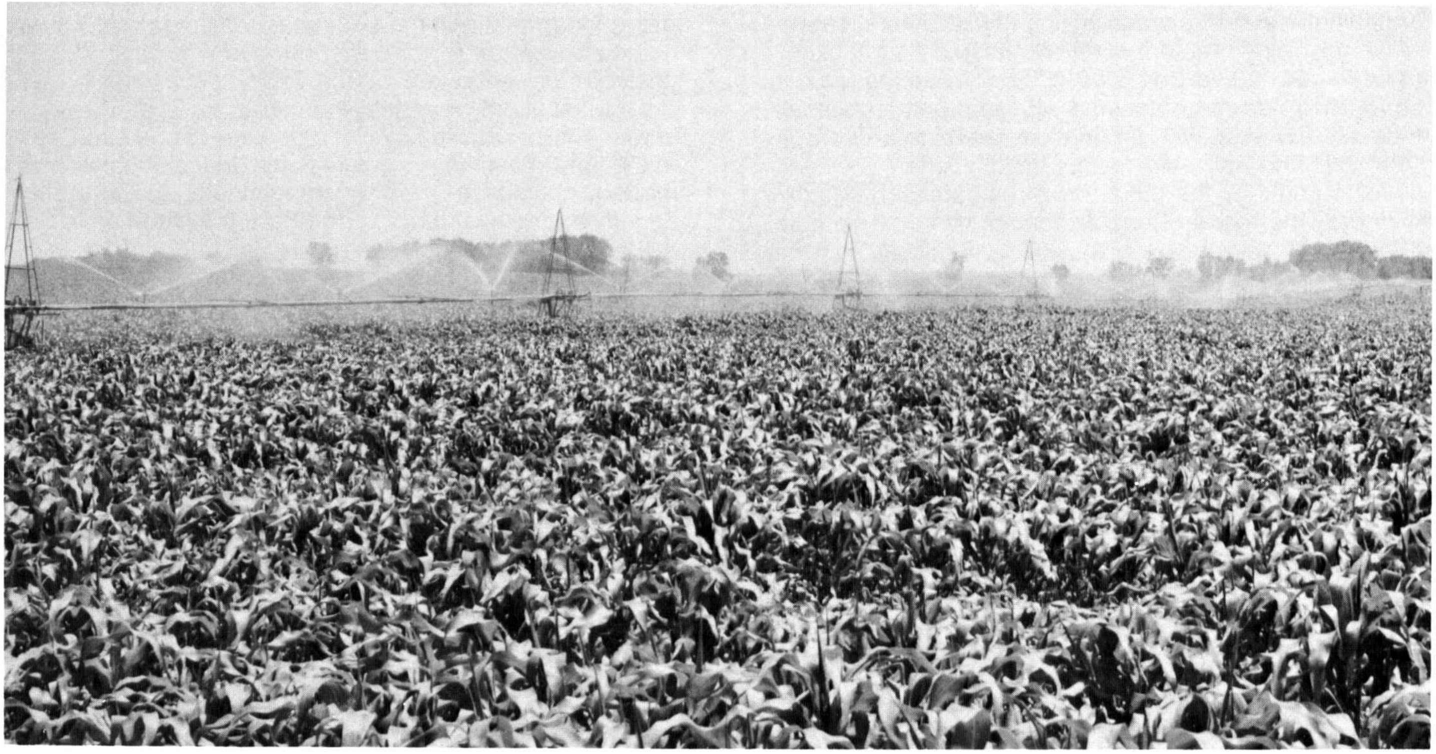


Figure 10.—Dunday loamy fine sand, 0 to 3 percent slopes, if irrigated, is well suited to corn.

fine sand. The underlying material, to a depth of 60 inches, is light brownish gray fine sand. In places, a layer of loamy material or soft sandstone is below a depth of 40 inches. In some areas, the subsoil has a slight accumulation of clay. In places, much of the surface layer has been removed through soil blowing and redeposited as hummocks.

Typically, the surface layer of the Duda soil is very friable, dark grayish brown loamy fine sand about 5 inches thick. The layer below that is brown, very friable loamy fine sand about 2 inches thick. The underlying material is mainly loamy fine sand and is light brownish gray in the upper part and light gray in the lower part. Hard sandstone is at a depth of about 26 inches. In some areas, the sandstone is at a depth of more than 40 inches or less than 20 inches. In places, the subsoil has a slight accumulation of clay. In some areas, the surface layer is fine sandy loam.

Included in mapping and making up 10 to 15 percent of this map unit are small areas of Ipage, Simeon, and Valentine soils. Ipage soils are moderately well drained and are in swales. Simeon soils are deep. They formed in deep, coarse sandy material on low ridges and in swales. Valentine soils are deeper than the Duda soil and have a thinner surface layer than the Dunday soil. They are in higher positions on the landscape.

The surface layer of these soils is easy to till within a wide range in moisture content. Runoff is slow to very slow because moisture is readily absorbed by the soil. Permeability is moderately rapid to rapid. The available water capacity is low. The organic matter content is moderately low to low. The root zone in the Duda soil is restricted by sandstone. The Dunday soil is neutral throughout. The Duda soil is neutral in the surface layer and mildly alkaline in the underlying material.

In most areas, these soils are in native grass and are used for hay or grazing. In some areas, they are used for dryfarmed alfalfa that is grown for hay. About 25 percent of the acreage is used for cultivated crops. Most of this cropland is irrigated. These soils have poor potential for dryfarmed crops, fair potential for gravity-irrigated crops, and good potential for sprinkler-irrigated crops. They have fair potential for recreation uses and for use as pasture or rangeland. They have good potential for trees in windbreaks and good to fair potential for the development of habitat for openland and rangeland wildlife. These soils have good potential for use as sites for roads and streets, poor potential for sanitary facilities, and fair potential for use as dwelling sites.

These soils are only marginally suited to dryfarmed row crops. They are best suited to close-growing crops such as alfalfa and grass. If these soils are cultivated, soil blowing is a moderate to severe hazard.

Droughtiness due to the underlying material and low fertility are limitations to the use of these soils as cropland. Leaving crop residue on the surface helps to reduce soil blowing and to improve the organic matter content of the soils. Narrow windbreaks also help to reduce soil blowing.

If these soils are irrigated, they are suited to alfalfa, pasture grasses, close-growing crops, corn, and sorghum. The only irrigation system that is suitable on these soils is the sprinkler system. These soils are especially well suited to the center-pivot system of sprinkler irrigation. Maintaining a large amount of crop residue on the surface, stripcropping, field windbreaks, minimum tillage, and applying fertilizer help to control soil blowing and maintain fertility.

Using these soils as rangeland is effective in controlling soil blowing. However, overgrazing the rangeland or using improper haying methods reduces the vegetative cover, causes deterioration of the plant community, increases soil blowing, and creates blowouts. Proper range use, deferred grazing or haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil. The small blowouts can be fenced to exclude livestock and then stabilized by mulching and reseeding.

These soils are poorly suited to sanitary facilities because of the moderate depth to sandstone of the Duda soil and the hazard of seepage. Depending on the hardness of the sandstone and the depth to sandstone, percolation can be a problem in septic tank absorption fields. Lateral seepage of waste above the sandstone can cause contamination of well water. If these soils are used for sewage lagoons, the bottom will need to be sealed with less permeable soil material or sealed with a chemical sealer to prevent seepage. These soils are limited for building site development by the tendency of embankments to cave in and by the moderate depth to sandstone. A suitable material will be needed for back fill or landscaping if these soils are used as a building site. The sandy texture of the surface layer and soil blowing are moderate limitations to camp areas, playgrounds, and trails. If local streets and roads are built on these soils, soil blowing can cause problems, and banks and ditches will need to be revegetated.

The capability unit is IVe-5, dryland, and IIIe-11, irrigated; these soils are in the Sandy range site; they are in windbreak suitability group 3.

Eo—Els fine sand, 0 to 2 percent slopes. This is a deep, nearly level, somewhat poorly drained soil on bottom lands and in upland swales. This soil is rarely flooded. The areas generally are elongated and range from 5 to 100 acres.

Typically, the surface layer is loose, gray fine sand about 7 inches thick. The layer below that is loose, light brownish gray fine sand about 6 inches thick. The underlying material, to a depth of 60 inches, is light gray and white fine sand. In some areas, the surface layer is loamy sand or loamy fine sand. In places, the soil is dark to a depth of more than 10 inches.

Included in mapping are small areas of Dunday, Ipage, Loup, Ronson, Tassel, and Valentine soils. Dunday soils are well drained and have a thicker surface layer than this Els soil. Ipage soils are moderately well drained; they are on hummocks in slightly higher positions on the landscape. Loup soils are very poorly drained and are in lower positions on the landscape. Ronson soils are moderately deep, and Tassel soils are shallow over sandstone. These two soils are in slightly higher positions on the landscape. Valentine soils are excessively drained and are in higher positions on the landscape than this Els soil. Also included are small areas of saline and alkali soils. The included soils make up 10 to 15 percent of this map unit.

Permeability is rapid, and runoff is slow. The available water capacity is low. The seasonal high water table is at a depth of 1.5 feet in wet years and 3.5 feet in dry years. The soil is mildly alkaline. The organic matter content is low.

This soil is used mainly as hayland or rangeland. In a few areas, it is used for cultivated crops. This soil has good potential for native grasses for grazing or hay. It has very poor potential for dryfarmed cultivated crops and poor potential for irrigated crops. This soil has fair potential for trees and shrubs in windbreaks and for the development of habitat for wetland or rangeland wildlife. It has poor potential for sanitary facilities, building site development, and recreation uses.

This soil is poorly suited to dryfarmed corn or sorghum because of wetness, which delays planting in spring and can prevent cultivation in wet periods. This soil generally is better suited to alfalfa and other close-growing crops, which help to control soil blowing when the surface soil is dry. In some places, however, the high water table can drown out the alfalfa. If this soil is cultivated, it is subject to soil blowing. Soil blowing can be reduced through stubble-mulch tillage, by returning crop residue to the soil, and by planting winter cover crops and close-grown crops.

If this soil is irrigated, it is poorly suited to corn and sorghum. It generally is better suited to alfalfa and tame grasses. A sprinkler irrigation system is the most suitable on this soil. The applications of irrigation water need to be light and frequent to prevent waterlogging and the loss of nutrients. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

This soil is well suited to use as native hayland and rangeland. If this soil is used as hayland, the grasses generally have low vigor. The vigor of the grasses can be maintained or improved by harvesting the hay in midsummer, which leaves enough aftergrowth to produce plant food for the grasses in winter and early in spring. Returning some of the hay to the soil helps to maintain soil fertility. Applying phosphate fertilizer is beneficial for legumes which then add nitrogen to the soil. If this soil is used as rangeland, grass vigor can be

maintained through proper stocking and a planned grazing system. Overgrazing the rangeland reduces grass production, encourages weeds, and can increase soil blowing.

This soil has fair suitability for windbreaks. Only trees and shrubs that can tolerate the high water table of this soil are suitable. Establishing trees can be difficult in wet years. Competition from grasses or weeds is a limitation to establishing a stand of trees. Site preparation and cultivation for several years after planting can increase the survival and growth rate of the trees.

This soil is severely limited for use as septic tank absorption fields and for sewage lagoons. If sewage lagoons are constructed, the bottom needs to be sealed or lined to prevent seepage. Wetness is a limitation for use as sites for houses. If confined and compacted, this soil has fair suitability for use as roadfill. Because of the high water table, large fills are required for highway construction. Wetness and the sandy texture of the surface layer are severe limitations to recreation uses.

The capability unit is VIw-5, dryland, and IVw-12, irrigated; this soil is in the Subirrigated range site; it is in windbreak suitability group 2.

Es—Elsmere loamy fine sand, 0 to 2 percent slopes. This is a deep, nearly level, somewhat poorly drained soil. This soil is in low areas of sandhill valleys, on stream terraces, or on foot slopes along the streams that flow from the sandhill valleys. It is rarely flooded. The areas are irregular in shape and range from 10 to 200 acres.

Typically, the surface soil is very friable, dark gray loamy fine sand about 12 inches thick. The layer below that is light brownish gray loamy fine sand about 12 inches thick. The underlying material, to a depth of 60 inches, is light gray and grayish brown fine sand that has yellowish brown mottles. In places, the surface soil is fine sandy loam or fine sand. In some areas, the soil is dark to a depth of less than 10 inches thick. In some areas, a buried layer of very dark gray fine sandy loam or loamy fine sand is at a depth of 30 to 40 inches.

Included in mapping are areas of Dunday, Inavale, Ipage, Loup, and Valentine soils. Also included are small areas of saline and alkali soils. These included soils make up 10 to 25 percent of this map unit. The well drained Dunday soils and excessively drained Valentine soils are in higher positions on the landscape and are more subject to soil blowing than this Elsmere soil. Ipage soils are moderately well drained and are in slightly higher landscape positions. Loup soils are in low areas and are poorly drained or very poorly drained. Inavale soils are in slightly higher positions on the landscape and are somewhat excessively drained.

Permeability is rapid and runoff is slow. The available water capacity is low above the water table. The seasonal water table is at a depth of 1.5 feet in wet years and 2.5 feet in dry years. The soil is mildly alkaline.

This soil is used mainly as hayland or rangeland. In a few areas, it is used for cultivated crops. This soil has good potential for native grasses for grazing or hay. It has poor potential for dryfarmed or irrigated cultivated crops. This soil has fair potential for tame grasses, for trees and shrubs in windbreaks, and for the development of habitat for wetland or rangeland wildlife. It has poor potential for sanitary facilities and building site development and fair to poor potential for recreation uses.

This soil is poorly suited to dryfarmed corn or sorghum because wetness delays plantings in spring and can prevent cultivation in wet periods. This soil generally is better suited to alfalfa and other close-growing crops. These crops do not require tillage in spring and can help to control soil blowing when the soil at the surface is dry. In some places, however, the high water table can drown out the alfalfa. If this soil is cultivated, it is subject to soil blowing. Soil blowing can be reduced through a stubble-mulch tillage, by returning crop residue to the soil, and by planting winter cover crops and close-grown crops. Barnyard manure and commercial fertilizer need to be added to this soil.

If this soil is irrigated, it is poorly suited to corn and sorghum. It generally is better suited to alfalfa and tame grasses. A sprinkler irrigation system is the most suitable on this soil. The application of irrigation water needs to be light and frequent to prevent waterlogging and leaching of nutrients. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

This soil is well suited to use as native hayland and rangeland. If this soil is used as hayland, the grasses generally have low vigor. The vigor of the grasses can be maintained or improved by harvesting the hay in midsummer, which leaves enough aftergrowth to produce plant food for the grasses in winter and early in spring. Returning some of the hay to the soil helps to maintain soil fertility. Applying phosphate fertilizer is beneficial to legumes which then add nitrogen to the soil. If this soil is used as rangeland, grass vigor can be maintained through proper stocking and a planned grazing system. Overgrazing the rangeland reduces grass production, encourages weeds, and can increase soil blowing.

This soil has fair suitability for windbreaks. Only trees and shrubs that can tolerate the high water table of this soil are suitable. Establishing trees can be difficult in wet years. Competition from grasses or weeds is a limitation to establishing a stand of trees. Site preparation and cultivation for several years after planting can increase the survival and growth rate of the trees.

This soil is severely limited for use as septic tank absorption fields and for sewage lagoons. If sewage lagoons are constructed, the bottom needs to be sealed or lined to prevent seepage. Wetness is a limitation to shallow excavations and to use as sites for houses. If confined and compacted, this soil has fair suitability for use as roadfill. Because of the high water table, large fills generally are required for highway construction.

Wetness and the sandy texture of the surface layer are severe limitations to recreation uses.

The capability unit is IVw-5, dryland, and IVw-11, irrigated; this soil is in the Subirrigated range site; it is in windbreak suitability group 2.

Ho—Holt fine sandy loam, 0 to 2 percent slopes. This is a moderately deep, nearly level, well drained soil on tablelands. The areas range from 4 to 80 acres.

Typically, the surface layer is very friable, dark grayish brown fine sandy loam about 6 inches thick. The subsurface layer is very friable, very dark grayish brown fine sandy loam about 4 inches thick. The subsoil extends to a depth of 21 inches; it is dark grayish brown and brown fine sandy loam. The underlying material is calcareous, light gray loamy fine sand. Consolidated sandstone is at a depth of about 34 inches. In a few areas, the surface layer is loam. In places, stones are in the lower part of the subsoil. In some areas, sandstone is at a depth of more than 40 inches.

Included in mapping are small areas of Duda and Tassel soils. The Duda soils are more sandy than this Holt soil. Their position on the landscape is similar to that of the Holt soil. Tassel soils are shallow over sandstone. The included soils make up less than 10 percent of this map unit.

The surface layer is easy to till within a wide range in moisture content. In places, stones that are on or near the surface interfere with tillage. Runoff is medium. Permeability is moderate. The available water capacity is low. The organic matter content is moderately low. The root zone generally is restricted by the sandstone at a depth of 20 to 40 inches. The surface layer and subsoil are neutral to mildly alkaline.

In most areas, this soil has at one time been used for farming. In many areas, it is now used as rangeland or pasture. This soil has fair potential for use as dryfarmed or gravity-irrigated cropland. It has good potential for cultivated crops if a sprinkler irrigation system is used. This soil has fair potential for grasses for hay or grazing, for trees in windbreaks, and for use as sites for houses and roads and streets. It has good potential for recreation uses and for the development of habitat for rangeland and openland wildlife. The potential for sanitary facilities is poor.

This soil has fair suitability for dryfarmed corn, alfalfa, small grains, and grasses and legumes. Soil blowing is a moderate hazard, and water erosion is a slight hazard. This soil is droughty in years of below average rainfall. This droughtiness can cause a low yield or failure of crops. Conservation tillage that leaves crop residue on the surface, contour farming, stripcropping, and field windbreaks help to control erosion and conserve moisture.

If this soil is irrigated, it is suited to most crops commonly grown in the county. A sprinkler irrigation system, for example, the center-pivot sprinkler system, generally is the most suitable because it can provide the light, frequent applications of water needed on this soil. A gravity irrigation system also can be used, but land leveling will be needed in some areas. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

This soil is well suited to use as rangeland. Using this soil as rangeland is effective in controlling soil blowing and water erosion. However, overgrazing the rangeland or using improper haying methods reduces the vegetative cover, causes deterioration of the plant community, and can increase soil blowing. Proper range use, deferred grazing and haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil is suited to trees in windbreaks; however, soil blowing needs to be controlled by maintaining a strip of sod or other vegetation between the rows of trees. Droughtiness and competition from grasses and weeds for moisture are hazards to seeding establishment. Only trees and shrubs that are tolerant of droughtiness and the high calcium carbonate content of this soil are suitable.

This soil is poorly suited to sanitary facilities because of the moderate depth to sandstone and the hazard of seepage. Depending on the hardness of the sandstone and the depth to sandstone, percolation can be a problem in septic tank absorption fields. Lateral seepage of waste above the sandstone can cause contamination of well water. If this soil is used for sewage lagoons, the bottom will need to be sealed or lined with less permeable soil material or a chemical sealer to prevent seepage. This soil is limited for building site development because of the moderate depth to sandstone. A suitable material will be needed for back fill or landscaping if this soil is used as a building site. The moderate depth over sandstone, frost action, and low soil strength are limitations to the use of this soil for local roads and streets. If local roads and streets are constructed, excavation of the sandstone will be necessary, a suitable material will need to be added in the subgrade to strengthen the roadbed, and a waterproof surface, subgrade barriers, and surface drainage will be needed to prevent damage caused by frost action.

The capability unit is IIIe-3, dryland, and IIIe-9, irrigated; this soil is in the Sandy range site; it is in windbreak suitability group 5.

HoC—Holt fine sandy loam, 2 to 6 percent slopes. This is a moderately deep, gently sloping, well drained soil on knolls, convex ridgetops, and the upper part of side slopes. The areas are small and circular or long and narrow. They range from 4 to 30 acres.

Typically, the surface layer is very friable, grayish brown, light fine sandy loam 3 inches thick. The subsurface layer is very friable, dark grayish brown fine sandy loam about 4 inches thick. The subsoil is about 15 inches thick. It is brown, very friable fine sandy loam in the upper part and light brownish gray, friable fine sandy

loam in the lower part. Consolidated, calcareous sandstone is at a depth of 22 inches. In places, the original surface layer has been completely eroded. In some areas, the plow layer is loamy fine sand.

Included in mapping are small areas of Duda and Tassel soils. Duda soils are more sandy than this Holt soil. Their position on the landscape is similar to that of the Holt soil. Tassel soils are shallow over sandstone; they are in the higher positions on the landscape. Also included are areas of rock outcrop on ridgetops. These inclusions make up 5 to 15 percent of this map unit.

The surface layer is easy to till within a wide range in moisture content. In places, stones that are on or near the surface interfere with tillage. Runoff is medium. Permeability is moderate. The available water capacity is low. The organic matter content is moderately low. The root zone is restricted by sandstone at a depth of 20 to 40 inches. The surface layer and subsoil are neutral to mildly alkaline.

In most areas, this soil has at one time been used for farming. In many areas, it is now used as rangeland or pasture. This soil has fair potential for dryfarmed cultivated crops. It has poor potential for crops if a gravity irrigation system is used and fair potential if a sprinkler irrigation system is used. This soil has fair potential for grasses for hay or grazing, for trees in windbreaks, and for use as sites for houses and roads and streets. This soil has good potential for recreation uses and for the development of habitat for rangeland and openland wildlife. It has poor potential for sanitary facilities.

This soil is suited to dryfarmed corn, alfalfa, small grains, and grasses and legumes. Soil blowing is a moderate hazard, and water erosion is a slight hazard. This soil is droughty in years of below-average rainfall. The droughtiness can cause a low yield or failure of crops. Conservation tillage that leaves crop residue on the surface, contour farming, stripcropping, and field windbreaks can help to control erosion and conserve moisture.

If this soil is irrigated, it is suited to most crops commonly grown in the county. A sprinkler irrigation system, for example, the center-pivot sprinkler system, generally is the most suitable because it requires no land leveling and can provide the light, frequent application of water needed on this soil. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

This soil is well suited to use as rangeland. Using this soil as rangeland is effective in controlling soil blowing and water erosion. However, overgrazing the rangeland or using improper haying methods reduces the vegetative cover, causes deterioration of the plant community, and can increase soil blowing. Proper range use, deferred grazing and haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil is suited to trees in windbreaks; however, soil blowing needs to be controlled by maintaining a strip of sod or other vegetation between the rows of trees. Droughtiness and competition from grasses and weeds for moisture are limitations to seeding establishment. Only trees and shrubs that are tolerant of droughtiness and the high calcium carbonate content of this soil are suitable.

This soil is poorly suited to sanitary facilities because of the moderate depth to sandstone and the hazard of seepage. Depending on the hardness of the sandstone and the depth to sandstone, percolation can be a problem in septic tank absorption fields. Lateral seepage of waste above the sandstone can cause contamination of well water. If this soil is used for sewage lagoons, the bottom will need to be sealed or lined with less permeable soil material or a chemical sealer to prevent seepage. This soil is limited for building site development because of the moderate depth to sandstone. The moderate depth to sandstone, frost action, and low soil strength are limitations to the use of this soil as a site for local roads and streets. If local roads and streets are constructed, a waterproof surface, subgrade barriers, and surface drainage will be needed to prevent damage caused by frost action.

The capability unit is IIIe-3, dryland, and IIIe-9, irrigated; this soil is in the Sandy range site; it is in windbreak suitability group 5.

HtC—Holt-Tassel fine sandy loams, 3 to 6 percent slopes. This map unit consists of moderately deep and shallow, gently sloping and undulating, well drained soils on uplands. The areas of this map unit range from 5 to 30 acres.

This unit is 50 to 75 percent Holt soil and 15 to 30 percent Tassel soil. The Holt soil is on concave slopes, and the Tassel soil is on low ridgetops and hummocks. These soils are intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Holt soils is very friable, dark grayish brown fine sandy loam about 7 inches thick. The subsoil extends to a depth of 15 inches; it is grayish brown and light brownish gray, very friable, calcareous fine sandy loam. The underlying material is light gray, calcareous loamy fine sand. Sandstone is at a depth of 36 inches. In places, the surface layer is thicker and darker than is typical. In a few areas, it is loamy fine sand.

Typically, the surface layer of the Tassel soil is very friable, dark grayish brown, calcareous fine sandy loam about 6 inches thick. The underlying material is light brownish gray, calcareous, stony fine sandy loam. Weathered sandstone is at a depth of 9 inches. In places, small stones are on the surface. In some areas, the surface layer is loamy fine sand.

Included in mapping are small areas of Duda, Manter, and Vetal soils. These soils make up 5 to 15 percent of this map unit. Duda soils are more sandy than the Holt soil and are in the same landscape positions. Manter

and Vetal soils are in swales and on flats; they have sandstone at a depth of more than 40 inches.

Permeability is moderate in the Holt soil and moderately rapid in the Tassel soil. The available water capacity of these soils is low. Runoff is medium. These soils are easy to work within a wide range in moisture content. In some places, there are stones on the surface that hinder tillage.

In most areas, these soils have at one time been used for cultivated crops. In many areas, they are now used for crops in rotation with hay and pasture or as rangeland. In a few areas, they are used as sprinkler-irrigated cropland. These soils have poor potential for use as dryfarmed or gravity-irrigated cropland. They have fair potential for use as sprinkler-irrigated cropland. These soils have fair to poor potential for grasses for hay or grazing and fair to very poor potential for trees in windbreaks. They have fair potential for recreation uses and for use as sites for houses and roads and streets. These soils have poor potential for sanitary facilities. The Holt soil has good potential for the development of habitat for rangeland and openland wildlife, and the Tassel soil has poor to very poor potential.

These soils are suited to dryfarmed alfalfa, small grains, and grasses and legumes. Soil blowing and water erosion are moderate hazards. These soils are droughty in years of below average rainfall. The droughtiness can cause a low yield or failure of crops. Conservation tillage that leaves crop residue on the surface, contour farming, stripcropping, and field windbreaks help to control erosion and conserve moisture.

If these soils are irrigated, they are suited to most of the crops commonly grown in the county. A sprinkler irrigation system, for example, the center-pivot sprinkler system, generally is the most suitable because it requires no land leveling and can provide the light, frequent applications of water needed on these soils. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

These soils are well suited to use as rangeland. Using these soils as rangeland is effective in controlling soil blowing and water erosion. However, overgrazing the rangeland or using improper haying methods reduces the protective cover, causes deterioration of the plant community, and can increase soil blowing. Proper range use, deferred grazing and haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

These soils are suited to trees in windbreaks; however, soil blowing needs to be controlled by maintaining a strip of sod or other vegetation between the rows of trees. Droughtiness and competition from grasses and weeds for moisture are limitations to seeding establishment. Only trees and shrubs that are tolerant of droughtiness and the high calcium carbonate content of these soils are suitable. The use of machinery in planting trees is hindered in some areas by the shallowness to sandstone.

These soils are poorly suited to sanitary facilities because of the shallow to moderate depth to sandstone and the hazard of seepage. Depending on the hardness of the sandstone and the depth to sandstone, percolation can be a problem in septic tank absorption fields. Lateral seepage of waste above the sandstone can cause contamination of well water. If these soils are used for sewage lagoons, the bottom will need to be sealed or lined with less permeable soil material or a chemical sealer to prevent seepage. These soils are limited for use as sites for houses that have a basement because of the shallow to moderate depth to sandstone. A suitable material will be needed for backfill or landscaping if these soils are used as a building site. The shallow to moderate depth over sandstone, frost action, and low soil strength are limitations to the use of these soils for local roads and streets. If local roads and streets are constructed, excavation of the sandstone will be necessary, a suitable material will need to be added in the subgrade to strengthen the roadbed, and a waterproof surface, subgrade barriers, and surface drainage will be needed to prevent damage caused by frost action.

The capability unit is IVe-3, dryland, and IVe-9, irrigated; the Holt soil is in the Sandy range site and in windbreak suitability group 5; the Tassel soils is in the Shallow Limy range site and in windbreak suitability group 10.

HtD—Holt-Tassel fine sandy loams, 6 to 11 percent slopes. This map unit consists of moderately deep and shallow, strongly sloping, well drained soils on ridges and side slopes on uplands. The areas range from 5 to 60 acres.

This unit is 40 to 70 percent Holt soil and 20 to 35 percent Tassel soil. The Holt soil is on the lower part of concave slopes, and the Tassel soil is on ridgetops and the upper part of side slopes. These soils are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Holt soil is very friable, grayish brown fine sandy loam about 6 inches thick. The subsoil is about 16 inches thick. It is brown, friable fine sandy loam in the upper part and light gray, calcareous fine sandy loam in the lower part. Weathered, calcareous sandstone is at a depth of about 22 inches. In some areas, the surface layer is thicker and darker than is typical, and the sandstone is below a depth of 40 inches. In places, fine and medium gravel is on the surface of the soil. In some areas, the plow layer extends into the subsoil.

Typically, the surface layer of the Tassel soil is very friable, grayish brown, calcareous fine sandy loam about 3 inches thick. The underlying material is white loamy fine sand. Calcareous, weathered sandstone is at a depth of about 11 inches. In places, small stones are on the surface. In some areas, the plow layer is loamy fine sand.

Included in mapping are small areas of Duda, Jansen, and Meadin soils. These soils make up 10 to 15 percent of this map unit. Duda soils are more sandy than the Holt soil and are on a more hummocky landscape. Jansen soils have a finer textured subsoil than the Holt and Tassel soils and are moderately deep over sand and gravel; they are in higher and more level positions on the landscape. Meadin soils are on ridgetops and are shallow over gravel.

Permeability is moderate in the Holt soil. In the Tassel soil, it is moderately rapid above the sandstone. The available water capacity of these soils is low. Runoff is medium. These soils are easy to work within a wide range in moisture content. In places, there are stones on the surface that hinder tillage.

In most areas, these soils are used as native rangeland. In a few areas, they are used for alfalfa. These soils have poor potential for most cultivated crops. They have fair to poor potential for grasses and alfalfa for hay or grazing and fair to very poor potential for trees in windbreaks. These soils have fair potential for recreational development and for use as sites for houses and roads and streets. They have poor potential for sanitary facilities. The Holt soil has good potential for the development of habitat for openland and rangeland wildlife, and the Tassel soil has very poor potential.

These soils are not suited to cultivated crops. If these soils are used for farming, soil blowing and water erosion are severe hazards because of droughtiness and the steepness of slopes. Even if a sprinkler irrigation system is used, erosion results from the runoff of irrigation water. In some areas, these soils are suited to alfalfa; however, establishing the stand of alfalfa can be difficult, and production generally is limited to one cutting early in summer because of the droughtiness later in summer.

Using these soils as rangeland is effective in controlling erosion. However, overgrazing the rangeland reduces the vegetative cover, reduces the yield of grass, increases the hazard of erosion, and causes the invasion of undesirable weeds and woody plants. Proper stocking and a planned grazing system can help to maintain the vigor of the grass.

These soils are poorly suited to trees in windbreaks because erosion is a severe limitation to site preparation and cultivation. Conifers are the most suitable trees for use in windbreaks. Most areas are not suitable for machine planting because of the shallowness to sandstone and the steepness of slopes.

These soils are poorly suited to sanitary facilities because of the shallow to moderate depth to sandstone, the hazard of seepage, and the steepness of slopes. Depending on the hardness of the sandstone and the depth to sandstone, percolation can be a problem in septic tank absorption fields. Lateral seepage of waste above the sandstone can cause contamination of well water. If these soils are used as septic tank absorption fields, the limitation of slope can be overcome by running laterals on the contour across the slopes. If these soils are used for sewage lagoons, the bottom will need to be sealed or lined with less permeable soil material or a chemical sealer to prevent seepage. These soils are limited for building site development because of the shallow to moderate depth to sandstone. A suitable material will be needed for back fill or landscaping if these soils are used as a building site. The shallow to moderate depth to sandstone, frost action, and low soil strength are limitations to these soils for local roads and streets. If local roads and streets are constructed, excavation of the sandstone will be necessary, a suitable material will need to be added in the subgrade to strengthen the roadbed, and a waterproof surface, subgrade barriers, and surface drainage will be needed to prevent damage caused by frost action.

The capability unit is IVe-3, dryland, and IVe-9, irrigated; the Holt soil is in the Sandy range site and in windbreak suitability group 5; the Tassel soil is in the Shallow Limy range site and in windbreak suitability group 10.

IfD—Inavale fine sand, 3 to 11 percent slopes. This is a deep, somewhat excessively drained soil. It is on bottom lands of the major streams but is rarely flooded. It is on long, narrow, hummocky ridges that are 5 to 30 feet higher than the adjacent soils and that generally run parallel to the stream. This soil formed in sandy alluvium that has been reworked by the wind. The areas range from 5 to 60 acres.

Typically, the surface layer is grayish brown, loose fine sand about 5 inches thick. The layer below that is light brownish gray, loose fine sand about 6 inches thick. The underlying material, to a depth of 60 inches, is light gray, stratified fine sand. In some places, the surface layer is loamy fine sand, and the slopes are very gentle.

Included in mapping are small areas of Boel and Cass soils. Boel soils are somewhat poorly drained. Cass soils are well drained, are finer textured, and have a thicker surface layer than this Inavale soil. Both of the included soils are slightly lower on the landscape than the Inavale soil. They make up 5 to 15 percent of this map unit.

Permeability is rapid. The available water capacity is low. Runoff is slow. The organic matter content is low. This soil absorbs water readily and releases it readily to plants. The seasonal water table is below a depth of 6 feet.

In most areas, this soil is used as native rangeland. The rangeland has a sparse cover of deciduous trees. In some small areas, this soil is used for cultivated crops; this cropland is mainly in areas where this soil is associated with finer textured, less sloping soils. This soil has very poor potential for use as dryfarmed cropland production and poor potential for use as irrigated cropland. It has fair potential for use as rangeland or pasture, for trees in windbreaks, and for the development of habitat for rangeland and openland wildlife. This soil has poor potential for sanitary facilities, building site development, and recreation uses.

This soil is not suited to dryfarmed cultivated crops because of droughtiness and the hazard of soil blowing. If this soil is irrigated, the only suitable crops are small grains, grasses, and legumes. This soil is not suitable for a gravity system of irrigation; however, a sprinkler irrigation system can be used. The applications of water must be frequent and light to prevent excessive leaching of nutrients.

This soil is well suited to native grasses. Using this soil as rangeland can be effective in controlling soil blowing. However, overgrazing the rangeland reduces the vegetative cover, causes deterioration of the plant community, increases soil blowing, and creates small blowouts. Proper range use, deferred grazing, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil generally is not well suited to field windbreaks; however, it has fair suitability for feedlots, range or livestock windbreaks, and recreation or wildlife plantings. The soil is so loose that trees need to be planted in shallow furrows and left uncultivated. Tree seedlings can be damaged by sandblasting or covered by drifting sand when winds are strong.

This soil is severely limited for use as a site for houses. Houses built at the lower elevations and those that have a basement are subject to flooding. If confined, this soil has good bearing strength. The walls of excavations are unstable and tend to cave in; the cutbanks need to be sloped to stabilize the excavations. This soil is suitable for use as septic tank absorption fields except in areas that are subject to flooding. If this soil is used for sewage lagoons, the bottom needs to be lined to prevent seepage. If local roads and streets are constructed, the exposed cut slopes need to be protected against erosion. In addition, some road fills are needed at the lower elevations because of the hazard of occasional flooding. This soil provides good subgrade material for surface roads, but it is not suitable for unsurfaced roads. This soil is severely limited for most recreation uses because of the sandy texture and instability of the soil.

The capability unit is VIe-5, dryland, and IVe-12, irrigated; this soil is in the Sands range site; it is in windbreak suitability group 7.

IgB—Inavale fine sand, channeled, 0 to 3 percent slopes. This is a deep, somewhat excessively drained soil on flood plains. This soil is subject to frequent flooding. The flooding generally occurs each spring, but it can also occur in other periods of the year. The landscape is dissected by old creek beds, sloughs, and channels that meander across the flood plain. The channels are 40 to 70 feet wide and 4 to 20 feet deep. The slopes are mainly less than 2 percent, but they are as much as 5 percent on some narrow benches, on streambanks, and in some gullied areas. The areas are long and narrow, and range from 5 to 100 acres in size.

Typically, the surface layer is loose, light gray fine sand about 6 inches thick. The underlying material, to a depth of about 66 inches, is light gray loamy fine sand; to a depth of 24 inches, it is pale brown sand. In some areas, the surface layer is loamy sand, and in others it is sandy loam. In places, the underlying material has strata of coarse sand and darker fine sandy loam. There are a few small fragments of calcareous sandstone in the underlying material. The water table is at a depth of about 6 feet.

Included in mapping are small areas of Barney, Boel, and Cass soils. Barney soils are poorly drained and generally are at the lowest elevations. Boel soils are somewhat poorly drained and are at a lower elevation than this Inavale soil. Cass soils have a thicker surface layer, are less sandy, and are at a higher elevation than the Inavale soil.

Permeability is rapid, and the available water capacity is low. The rate of water intake is rapid. Runoff is slow. The organic matter content is low.

This soil is used as rangeland. It has fair potential for use as pasture or rangeland. It has very poor potential for use as cropland and for trees in windbreaks. This soil has poor potential for sanitary facilities and building site development. It has fair potential for the development of habitat for rangeland wildlife.

This soil is not suitable for cultivation because of the frequent flooding. Erosion can result from the scouring action of the floodwater, and soil blowing is a hazard in areas where the soil is bare of vegetation.

This soil is best suited to grass or trees. Flooded areas that do not have an adequate cover of vegetation can be reseeded to grass for grazing. Using this soil as rangeland is effective in controlling soil blowing and water erosion. Overgrazing the rangeland reduces the vegetative cover and causes deterioration of the plant community. Proper range use and deferred grazing help to maintain or improve the condition of the rangeland and the soil.

This soil generally is not suitable for windbreaks. In some areas, it can be used for recreational, wildlife, and forestation plantings of tolerant trees or shrubs if the trees are planted by hand or by other special means. Wooded or brushy areas that are not used for grazing provide excellent habitat for wildlife.

This soil is severely limited for building site development, septic tank absorption fields, and sewage lagoons because of seepage and the frequent flooding. If local roads are constructed, they can be damaged by flooding unless protected by diversions, storm sewers, or drainage ditches.

The capability unit is VIw-7; this soil is in the Sandy Lowland range site; it is in windbreak suitability group 10.

IhB—Inavale loamy fine sand, 0 to 3 percent slopes. This is a deep, somewhat excessively drained soil on bottom lands adjacent to the major stream channels. This soil is occasionally flooded. The areas are long and narrow and range from 5 to 100 acres.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 5 inches thick. The layer

below that is light brownish gray, loose fine sand about 10 inches thick. The underlying material, to a depth of 60 inches, is light gray sand that has strata of fine sand and gravelly sand. In some areas, the surface layer is fine sand or fine sandy loam. In places, it is darker than is typical.

Included in mapping are small areas of Barney, Boel, Cass, and Munjor soils. Barney soils are poorly drained and are in the lower positions on the landscape, generally adjacent to the stream channel. Boel soils are somewhat poorly drained and are at the lower elevations. Cass soils have a thicker surface layer, are less sandy, and generally are in slightly lower positions on the landscape and farther from the stream channel than this Inavale soil. Munjor soils are less sandy and more calcareous than this Inavale soil. Their position on the landscape is similar to that of the Inavale soil. The included soils make up 5 to 20 percent of this map unit.

Permeability is rapid, and the available water capacity is low. Runoff is slow. These soils absorb moisture rapidly and release it readily to plants. The organic matter content is low. This soil commonly is deficient in nitrogen, phosphate, and sulfur. It can be worked within a wide range in moisture content but tends to be loose when dry.

In most areas, this soil is in native grass and is used for grazing. It is cultivated mainly in the larger areas or in areas where it is associated with finer textured soils. This soil has good potential for use as pasture and rangeland, for trees in windbreaks, and for the development of habitat for rangeland wildlife. It has poor potential for dryfarmed cultivated crops. It has good potential for crops if a sprinkler irrigation system is used. This soil has fair potential for recreation uses and poor potential for sanitary facilities and building site development.

This soil is only marginally suited to dryfarmed row crops. It is best suited to close-growing crops such as alfalfa, grass, and small grains. In cultivated areas, soil blowing is a moderate to severe hazard. Low fertility and droughtiness due to the underlying material are moderate limitations to the use of this soil for crops. The soil commonly is so loose that it is difficult to till. If this soil is used for row crops, narrow strips or fields of the row crops can be alternated with close-growing crops. Leaving crop residue on the surface helps to reduce soil blowing and improves the organic matter content of the soil. Narrow windbreaks also help to reduce soil blowing.

On irrigated land, corn and alfalfa are the main crops. Close-growing crops such as small grains, hay, and pasture grasses can also be grown. This soil is well suited to a sprinkler system of irrigation. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land. If this soil is irrigated, enough fertilizer needs to be applied to maintain the fertility of the soil.

Using this soil as rangeland or pasture is effective in controlling soil blowing and water erosion. Overgrazing the rangeland or using improper haying methods reduces the vegetative cover and causes deterioration of the plant community. Proper range use and deferred grazing or haying help to maintain or improve the condition of the rangeland and the soil.

This soil is well suited to field windbreaks, feedlot windbreaks, range or livestock windbreaks, and recreational or wildlife plantings. Only trees and shrubs that can tolerate the sandy, somewhat droughty condition of the soil are suitable. Inadequate moisture and the severe hazard of soil blowing are the main hazards to establishing trees. Soil blowing can be prevented by maintaining a strip of sod or other vegetation between the rows of trees.

This soil is severely limited for use as sites for houses. Houses built at the lower elevations and those that have a basement are subject to flooding. If confined, this soil has good bearing strength. The walls of excavations are unstable and tend to cave in; the cutbanks need to be sloped to stabilize the excavations. This soil is suited to use as septic tank absorption fields except in areas that are subject to flooding. If this soil is used for sewage lagoons, the bottom needs to be lined to prevent seepage. If local roads and streets are constructed, the exposed cut slopes need to be protected against erosion. In addition, some road fills are needed at the lower elevations because of the hazard of occasional flooding. This soil provides good subgrade material for surfaced roads, but it is not suitable for unsurfaced roads. This soil is severely limited for most recreation uses because of the sandy texture and instability of the soil.

The capability unit is IVe-5, dryland, and IIIe-11, irrigated; this soil is in the Sandy Lowland range site; it is in windbreak suitability group 3.

IpB—Ipage loamy fine sand, 0 to 3 percent slopes. This is a deep, nearly level and very gently sloping, moderately well drained soil on stream terraces and in sandhill valleys. The areas range from 5 to 500 acres.

Typically, the surface layer is dark gray, very friable loamy fine sand about 6 inches thick. The layer below that is brown fine sand about 8 inches thick. The underlying material, to a depth of 60 inches, is pale brown and light gray fine sand. The soil has yellowish brown mottles between depths of 14 and 36 inches. In some places, the surface layer is 10 to 18 inches thick. In a few places, it is fine sand or loamy sand. This soil commonly has loamy material and a dark-colored buried layer below a depth of 40 inches.

Included in mapping and making up 10 to 20 percent of this map unit are small areas of Els, Loup, and Valentine soils. Els and Loup soils are in the lower positions on the landscape. Els soils are somewhat poorly drained, and Loup soils are poorly drained and very poorly drained. Valentine soils are in higher positions on the landscape and are excessively drained. Also included are small areas where the soil has strata of loamy material or coarse sand at a depth of 20 to 40 inches.

Permeability is rapid, and the available water capacity is low. The organic matter content is low. The soil is slightly acid to neutral. Runoff is slow or very slow. The seasonal water table is at a depth of 3 feet in wet years and 6 feet in dry years.

In most areas, this soil is in native grass and is used for grazing or hay. In some small areas, it is used as cropland. This soil has poor potential for use as dryfarmed or gravity-irrigated cropland. It has fair potential for crops if a sprinkler irrigation system is used. This soil has good potential for use as rangeland and for growing trees and shrubs in windbreaks. It has fair potential for the development of habitat for openland and rangeland wildlife. This soil has poor potential for sanitary facilities and fair potential for building site development and recreation uses.

This soil is only marginally suited to dryfarmed corn and sorghum. It generally is better suited to small grains and alfalfa because these crops grow in spring, when rainfall is sufficient, and mature early in summer. Soil blowing is a severe hazard if this soil is cultivated. Unless protected, seedlings can be destroyed by soil blowing. Soil blowing can be reduced, moisture conserved, and the organic matter content and fertility maintained by maintaining a cover of crops, grass, or crop residue on the soil.

If this soil is irrigated, it is suited to corn, sorghum, small grains, alfalfa, and tame grasses. A sprinkler irrigation system, for example, the center-pivot sprinkler system, is the most suitable because it can provide the light, frequent applications of water needed on this soil to prevent the excessive leaching of plant nutrients. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

This soil is suited to trees in windbreaks; however, soil blowing needs to be controlled by maintaining a strip of sod or other vegetation between the rows of trees. Droughtiness and competition from grass and weeds for moisture are hazards to seedling establishment.

This soil is severely limited for septic tank absorption systems and sewage lagoons because of seepage and wetness; contamination of the underground water supply is a hazard. In some periods of the year, wetness can cause septic tank absorption fields to fail. If this soil is used for sewage lagoons, the bottom needs to be lined or sealed to prevent seepage. Wetness and frost action are moderate limitations to use as sites for houses and roads. Artificial drainage, footing drains, and basement sump pumps can be used to reduce wetness. This soil is limited for recreation uses because of the sandy texture of the surface layer.

The capability unit is IVe-5, dryland, and IVe-11, irrigated; this soil is in the Sandy Lowland range site; it is in windbreak suitability group 3.

Ja—Jansen fine sandy loam, 0 to 2 percent slopes. This is a nearly level, well drained soil on uplands. This soil is moderately deep over sand and gravel. The areas range from 5 to 160 acres.

Typically, the surface layer is very friable, dark grayish brown fine sandy loam about 6 inches thick. The subsoil is about 16 inches thick. It is very friable, dark grayish brown loam in the upper part, dark grayish brown, friable clay loam in the middle part, and brown, friable fine sandy loam in the lower part. The underlying material, to a depth of about 33 inches, is pale brown loamy fine sand; below that, it is pale brown, gravelly coarse sand. In places, the surface layer is loam, sandy loam, or loamy fine sand. In some areas, sand and gravel are at a depth of less than 20 inches.

Included in mapping are small areas of Brocksburg and O'Neill soils. Brocksburg soils are dark colored to a depth of more than 20 inches. O'Neill soils are more sandy than this Jansen soil. The included soils are on the same landscape as the Jansen soil; they make up 5 to 20 percent of this map unit.

The surface layer is easy to till within a wide range in moisture content. Permeability is moderate above the gravelly sand. Runoff is slow. The available water capacity is low, and this soil is droughty. The organic matter content is moderately low. The root zone generally is restricted by gravelly sand at a depth of 24 to 34 inches.

About 75 percent of the acreage was once used for cultivated crops; the rest is native rangeland. Much of the land that was once cultivated has been seeded to grasses and is used for hay and pasture. In a few areas, this soil is used as sprinkler-irrigated cropland. In a few small areas, it is used for windbreaks. This soil has fair potential for dryfarmed cultivated crops. It has good potential for most cultivated crops if a sprinkler or gravity system of irrigation is used. This soil has fair potential for use as hayland or rangeland, for trees and shrubs in windbreaks, and for the development of habitat for rangeland wildlife. This soil has good potential for the development of habitat for openland wildlife and for recreation uses. It has fair potential for use as sites for houses and roads and streets and poor potential for most sanitary facilities.

This soil has fair suitability for dryfarmed small grains, corn, sorghum, and alfalfa. It is not well suited to corn and sorghum because of droughtiness due to the underlying gravelly coarse sand. This soil generally is best suited to small grains and alfalfa because these crops grow and mature in spring when rainfall is highest. Mulch tillage and a cover crop on the soil most of the year help to conserve moisture and reduce soil blowing.

If this soil is irrigated, it is well suited to corn, sorghum, and alfalfa. Where land leveling is feasible, a furrow or border irrigation system is effective. The cuts should not be so deep that the coarse underlying material is exposed. A sprinkler irrigation system also is suitable. Because of the very low moisture-retention capacity of the underlying material, droughtiness is a hazard unless irrigation is timely. The application of water must be carefully managed to prevent the leaching of plant nutrients from the soil. The same practices needed to

control erosion in dryfarmed areas are needed on irrigated land.

If this soil is used as native rangeland, proper range use, deferred grazing, and a planned grazing system are necessary to maintain a vigorous stand of grass. Livestock distribution on rangeland can be improved by fencing and by placing water and salt for livestock in strategic locations. Overgrazing the rangeland reduces the grass cover and causes deterioration of the plant community.

This soil is suitable for trees in windbreaks. Only trees and shrubs that are tolerant of a shallow root zone and droughtiness are suitable for planting. Droughtiness and competition from grass and weeds for moisture are the main limitations to seedling establishment.

This soil is severely limited for sewage lagoons because of the very rapid permeability of the underlying gravel. Sewage lagoons can be constructed if they are sealed or lined to prevent seepage. This soil is severely limited for shallow excavations because cutbanks tend to cave in; the cutbanks should be sloped to stabilize the excavations. The shrink-swell potential of this soil is a moderate limitation to use as sites for houses and for local roads and streets. The soil material may need to be replaced or modified for these uses. This soil is a fair source of sand and gravel.

The capability unit is IIIe-3, dryland, and IIe-7, irrigated; this soil is in the Sandy range site; it is in windbreak suitability group 5.

Jn—Jansen loam, 0 to 2 percent slopes. This is a nearly level, well drained soil on uplands. It is moderately deep over gravelly sand. The areas range from 5 to 100 acres.

Typically, the surface layer is dark grayish brown, friable loam about 9 inches thick. The subsoil is grayish brown and brown, firm clay loam about 15 inches thick. The underlying material, to a depth of about 27 inches, is light brownish gray loamy sand; below that, it is light gray gravelly sand. In some areas, the surface layer is fine sandy loam. In places, the sand and gravel are within a depth of 20 inches.

Included in mapping are small areas of Brocksburg and O'Neill soils. Brocksburg soils are dark colored to a depth of more than 20 inches. O'Neill soils are more sandy than the Jansen soil. The included soils are at the same elevation as the Jansen soil. They make up 5 to 20 percent of this map unit.

The surface layer of this soil can easily be tilled within a fairly wide range in moisture content. Permeability is moderate above the gravelly sand. Runoff is slow. The available water capacity is low. The organic matter content is moderately low. The root zone generally is restricted by gravelly sand at a depth of 24 to 28 inches.

About 75 percent of the acreage is used for cultivated crops or for crops in rotation with hay and pasture. The rest is used as native rangeland or permanent pasture. This soil has fair potential for dryfarmed cultivated crops. It has good potential for most cultivated crops if a sprinkler or gravity irrigation system is used. This soil has fair potential for use as hayland or rangeland, for trees and shrubs in windbreaks, and for the development of habitat for rangeland wildlife. It has fair potential for use as sites for houses and roads and streets, good potential for recreation uses, and poor potential for most sanitary facilities.

This soil has fair suitability for dryfarmed small grains, corn, sorghum, and alfalfa. It is not well suited to corn and sorghum because of droughtiness due to the underlying gravelly coarse sand. This soil generally is best suited to small grains and alfalfa because these crops grow and mature in spring when rainfall is plentiful. Mulch tillage and a cover crop on the soil most of the year help to conserve moisture and reduce soil blowing.

If this soil is irrigated, it is well suited to corn, sorghum, and alfalfa. Where land leveling is feasible, a furrow or border irrigation system is effective. The cuts should not be so deep that the coarse underlying material is exposed. A sprinkler irrigation system also is suitable. Because of the very low moisture-retention capacity of the underlying material, droughtiness is a hazard unless irrigation is timely. The application of water must be carefully managed to prevent the leaching of plant nutrients from the soil. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

If this soil is used as native rangeland, proper range use, deferred grazing, and a planned grazing system are necessary to maintain a vigorous stand of grass. Livestock distribution on rangeland can be improved by fencing and by placing water and salt for livestock in strategic locations. Overgrazing the rangeland reduces the grass cover and causes deterioration of the plant community.

This soil has fair suitability for trees in windbreaks. Only drought-tolerant trees and shrubs are suitable for planting. Droughtiness and competition from grass and weeds for moisture are the main limitations to seedling establishment.

This soil is severely limited for sewage lagoons because of the very rapid permeability of the underlying gravel. Sewage lagoons can be constructed if they are sealed or lined to prevent seepage. This soil is severely limited for shallow excavations because cutbanks tend to cave in; the cutbanks should be sloped to stabilize the excavations. The shrink-swell potential of this soil is a moderate limitation to use as sites for houses and for local roads and streets. The soil material may need to be replaced or modified for these uses. This soil is a fair source of sand and gravel.

The capability unit is IIs-5, dryland, and IIs-7, irrigated; this soil is in the Silty range site; it is in windbreak suitability group 5.

JnC—Jansen loam, 2 to 6 percent slopes. This is a gently sloping, well drained soil on uplands. This soil is

moderately deep over gravelly sand. The areas are irregular in shape and range from 5 to 160 acres.

Typically, the surface layer is dark grayish brown, firm loam about 7 inches thick. The subsoil is about 17 inches thick. It is dark brown, friable loam in the upper part and brown, firm heavy loam in the lower part. The underlying material, to a depth of 60 inches, is pale brown gravelly sand. In some places, a layer of loam or very fine sandy loam is between the subsoil and the underlying gravelly sand. In areas where this soil is eroded, the plow layer consists mainly of material from the subsoil. In some areas, the surface layer is fine sandy loam.

Included in mapping are small areas of Brocksburg and O'Neill soils. Brocksburg soils are dark colored to a depth of more than 20 inches. O'Neill soils are more sandy than the Jansen soil. The included soils are at the same elevation as the Jansen soil. They make up 5 to 20 percent of this map unit.

The surface layer of this soil is easy to till within a fairly wide range in moisture content. Permeability is moderate above the gravelly sand. Runoff is slow. The available water capacity is low. The organic matter content is moderately low. The root zone generally is restricted by gravelly sand at a depth of 24 to 28 inches

About two-thirds of the acreage is used for cultivated crops or for crops in rotation with hay and pasture. The rest is used as native rangeland or permanent pasture. This soil has fair potential for use as dryfarmed or sprinkler-irrigated cropland. It has poor potential for crops if a gravity-irrigation system is used. This soil has fair potential for use as hayland or rangeland, for trees and shrubs in windbreaks, and for the development of habitat for rangeland wildlife. It has good potential for the development of habitat for openland wildlife and for recreation uses. This soil has fair potential for use as sites for houses and roads and streets and poor potential for most sanitary facilities.

This soil has fair suitability for dryfarmed small grains, corn, sorghum, and alfalfa. It is not well suited to corn and sorghum because of droughtiness due to the underlying gravelly coarse sand. This soil generally is best suited to small grains and alfalfa because these crops grow and mature in spring when rainfall is highest. Mulch tillage and a cover crop on the soil most of the year help to conserve moisture and reduce soil blowing.

If this soil is irrigated, it is well suited to corn, sorghum, and alfalfa. A sprinkler irrigation system is suitable. Because of the very low moisture-retention capacity of the underlying material, droughtiness is a hazard unless irrigation is timely. The application of water must be carefully managed to prevent the leaching of plant nutrients from the soil. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

If this soil is used as native rangeland, proper range use, deferred grazing, and a planned grazing system are necessary to maintain a vigorous stand of grass. Livestock distribution on rangeland can be improved by fencing and by placing water and salt for livestock in strategic locations. Overgrazing the rangeland reduces the grass cover and causes deterioration of the plant community.

This soil is suited to trees in windbreaks. Only drought-tolerant trees and shrubs are suitable. Droughtiness and competition from grass and weeds for moisture are the main hazards to seedling establishment.

This soil is severely limited for sewage lagoons because of the very rapid permeability of the underlying gravel. Sewage lagoons can be constructed if they are sealed or lined to prevent seepage. This soil is severely limited for shallow excavations because cutbanks tend to cave in; the cutbanks should be sloped to stabilize the excavations. The shrink-swell potential of this soil is a moderate limitation to use as sites for houses and for local roads and streets. The soil material may need to be replaced or modified for these uses. This soil is a fair source of sand and gravel.

The capability unit is IIIe-1, dryland, and IIIe-7, irrigated; this soil is in the Silty range site; it is in windbreak suitability group 5.

JoB—Jansen-Meadin loams, 0 to 3 percent slopes. This map unit consists of nearly level and gently undulating, well drained and excessively drained soils that are shallow and moderately deep over sand and gravel. These soils are on uplands. The areas range from 10 to several hundred acres.

This map unit is 40 to 55 percent Jansen soil and 35 to 50 percent Meadin soil. The Meadin soil is slightly lower on the landscape than the Jansen soil. These soils are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Jansen soil is dark gray, very friable loam about 3 inches thick. The subsurface layer is dark grayish brown, very friable loam about 9 inches thick. The subsoil is about 10 inches thick. It is grayish brown, friable loam in the upper part and brown, friable clay loam in the lower part. The underlying material, to a depth of 26 inches, is brown loamy coarse sand; below that, it is light brownish gray, gravelly coarse sand. In many places, the underlying material is stratified. In some areas, the surface layer is fine sandy loam or sandy loam.

Typically, the surface layer of the Meadin soil is dark grayish brown, firm loam about 6 inches thick. The subsurface layer is dark brown, friable loam about 4 inches thick. The layer below that is yellowish brown, very friable, very gravelly sand. The underlying material, to a depth of 60 inches, is stratified, yellowish brown, very gravelly sand. In some areas, the surface layer is fine sandy loam. In places, the gravelly sand is at a depth of less than 10 inches.

Included in mapping and making up 5 to 15 percent of this map unit are small areas of Brocksburg, Dunday, and O'Neill soils. Brocksburg soils are dark-colored to a

depth of more than 20 inches. Dunday soils are deep and sandy. O'Neill soils have a sandier subsoil than the Jansen soil. The included soils are in landscape positions similar to those of the Jansen soil.

The surface layer of the Jansen and Meadin soils is easy to till within a wide range in moisture content. Permeability is rapid in the Meadin soil. It is moderate above the gravelly sand in the Jansen soil and very rapid below that. Runoff on these soils is slow. The available water capacity is low to very low. These soils are droughty. The organic matter content is moderately low in the Jansen soil and low in the Meadin soil. The root zone generally is restricted by the coarse sand and gravel at a depth of 10 to 36 inches.

These soils are used mainly as native rangeland. In a few areas, they are used as irrigated cropland. These soils have poor potential for dryfarmed or irrigated cultivated crops. They have fair potential for use as rangeland, for trees in windbreaks, and for the development of habitat for rangeland wildlife. These soils have good potential for recreation uses. They have poor potential for sanitary facilities and good to fair potential for building site development.

These soils generally are not suited to dryfarmed cultivated crops because of the shallowness over sand and gravel, the low available water capacity of the soil, and the hazard of erosion.

If these soils are irrigated, they are poorly suited to corn, sorghum, and alfalfa because of shallowness and the low available water capacity of the soil. A sprinkler irrigation system is the only suitable system. A center-pivot sprinkler system is the most suitable because it provides the light, frequent applications of water needed on these soils. Because these soils are very droughty, irrigation is needed on these soils beginning early in the growing season and continuing until crops are mature. Fertilizer needs to be applied in combination with the irrigation. If excessive amounts of water are applied, nitrates will be leached below the root zone. Soil blowing can be a severe hazard if these soils are irrigated. A cover crop is needed on these soils throughout most of the year. Returning crop residue and adding barnyard manure to the soil help to improve the organic matter content, the fertility, and the available water capacity of the soils.

Using these soils as rangeland is effective in controlling soil blowing and water erosion. Overgrazing the rangeland or using improper haying methods reduces the vegetative cover and causes deterioration of the plant community. Proper range use, deferred grazing, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

The Jansen soil has fair suitability for trees in windbreaks. Only drought-tolerant trees and shrubs are suitable for planting. Droughtiness due to the low available water capacity of the soil and competition from grass and weeds for moisture are the main limitations to seedling establishment. The Meadin soil generally is not suitable for trees in windbreaks because of the shallowness over sand and gravel and the low available water capacity. In some areas, it can be used for recreational, wildlife, or forestation plantings of adapted trees or shrubs that are planted by hand or by other special means.

These soils are severely limited for sewage lagoons because of seepage. Sewage lagoons need to be lined or sealed to prevent seepage. Lateral seepage or downslope flow of effluent is a slight limitation to the use of these sloping soils as septic tank absorption fields. These soils are severely limited for shallow excavations because the excavation walls tend to cave in. The cutbanks need to be sloped to stabilize the excavations. The Jansen soil is severely limited for use as sites for roads and streets because of frost action, slope, and low soil strength.

The capability unit is IVs-4, dryland, and IVs-14, irrigated; the Jansen soil is in the Silty range site and in windbreak suitability group 5; the Meadin soil is in the Shallow to Gravel range site and in windbreak suitability group 10.

LaD—Labu silty clay, 6 to 11 percent slopes. This is a moderately deep, well drained, strongly sloping soil on convex ridgetops and the lower part of side slopes on uplands. The areas range from 5 to 60 acres.

Typically, the surface layer is firm, dark grayish brown silty clay about 5 inches thick. The subsoil is about 21 inches thick. It is firm, grayish brown clay in the upper part and olive brown, very firm clay in the lower part. Yellowish brown, bedded shale is at a depth of 26 inches. In places, the surface layer is thicker than is typical, and the bedded shale is at a greater depth. In a few areas, the surface layer is silty clay loam.

Included in mapping and making up 5 to 15 percent of this map unit are small areas of Reliance and Verdel soils, which are deeper than this Labu soil. Reliance soils are deep and are on ridgetops; they formed in silty wind-deposited material that overlies shale. Verdel soils are on foot slopes and are dark colored to a greater depth than the Labu soil.

This soil has poor tilth. Permeability is slow. Runoff is rapid, and the available water capacity is low. This soil absorbs water slowly and releases it slowly to plants. The shrink-swell potential is high. The organic matter content is low. The root zone is restricted below a depth of about 26 inches by bedded shale.

This soil is used about equally as cropland and rangeland. It has poor potential for farming and for trees in windbreaks. It has fair potential for use as rangeland and for the development of habitat for rangeland and openland wildlife. This soil has poor potential for sanitary facilities, building site development, and recreation uses.

This soil is only marginally suited to dryfarmed corn or sorghum. It is better suited to small grains, alfalfa, and tame grasses for hay. If this soil is used for cultivated crops, water erosion is a hazard. Terraces, minimum

tillage, and returning crop residue to the soil help to control erosion. A cover of grass helps to control erosion in the natural drainageways. Grasses and legumes in rotation with crops help to improve tilth and the organic matter content.

This soil is poorly suited to irrigated crops because of the fine texture of the soil and the steepness of slopes. The runoff of irrigation water can cause severe erosion.

This soil is suited to use as rangeland. On rangeland, an adequate cover of the native vegetation needs to be maintained to control erosion. Proper stocking, uniform grazing distribution, and a planned grazing system help to keep the rangeland in good condition.

This soil is not suitable for field windbreaks. It has fair suitability for farmstead and livestock windbreaks. Trees and shrubs grow poorly on this soil because of its high clay content. Only drought-tolerant trees and shrubs should be grown.

If this soil is used as sites for houses, foundations and footings should be designed to prevent structural damage caused by the shrinking and swelling of the soil. The underlying shale is relatively soft and unstable and can cause slippage. Drainage is needed around the housing site to prevent the soil and shale from becoming saturated. Local roads need to be graded to shed water, and a suitable base material obtained offsite needs to be added. This soil is poorly suited to use as septic tank absorption fields and sewage lagoons because of the moderate depth to shale, the slow permeability of the soil, and the steepness of slopes. Deeper, less sloping soils on the foot slopes and the broader ridgetops are more suitable for sanitary facilities. This soil is poorly suited to recreation uses because of the steepness of slopes and the clayey texture of the surface layer.

The capability unit is IVe-4; this soil is in the Clayey range site; it is in windbreak suitability group 9.

LcF—Labu-Sansarc silty clays, 11 to 30 percent slopes. This map unit consists of moderately steep and steep, well drained soils on upland ridges and side slopes. In most areas, the landscape is dissected by drainageways. The areas of this unit are elongated and range from 10 to 100 acres.

This map unit is 55 to 60 percent Labu soil and 20 to 25 percent Sansarc soil. The Labu soil is on the middle and lower parts of side slopes and on the broad ridgetops; the Sansarc soil is on narrow ridges, sharp slope breaks, and the upper part of the side slopes of some drainageways (fig. 11). These soils are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Labu soil is dark grayish brown, firm silty clay about 5 inches thick. The subsoil is grayish brown, very firm clay about 15 inches thick. The underlying material is light olive brown clay. Bedded shale is at a depth of 36 inches. In places, the bedded shale is at a depth of more than 40 inches. In some areas, on the lower part of side slopes, the surface layer is thicker than is typical.

Typically, the surface layer of the Sansarc soil is dark grayish brown, friable silty clay about 4 inches thick. The underlying material is grayish brown, friable silty clay; the soil is lighter in color as depth increases. Light brownish gray bedded shale is at a depth of about 17 inches. Below the surface layer, the soil material is calcareous.

Included in mapping and making up 15 to 25 percent of this map unit are small areas of Anselmo, Mariaville, Paka, Reliance, and Verdel soils and areas of stony soils and shale outcrop. Anselmo and Reliance soils are deep soils on rounded ridges; they formed in wind-deposited material that overlies the shale. Anselmo soils formed in loamy material, and Reliance soils formed in silty material. Mariaville and Paka soils are on steep side slopes and ridgetops; they formed in material that weathered from siltstone. Verdel soils are deep and are on the lower part of side slopes and on terraces along drainageways. In a few small areas on ridges and side slopes, fragments of sandstone, quartzite, or mudstone are on the surface. The fragments range in size from coarse gravel to boulders. In some areas, these stones are a limitation to agricultural use. There are outcrops of shale on some ridges.

The permeability of the Labu and Sansarc soils is slow. The available water capacity of the Labu soil is low, and that of the Sansarc soil is very low. These soils have a fine, plastic clay that holds some of the soil moisture under so much tension that the moisture cannot be extracted by plant roots. Runoff on these soils is rapid or very rapid. The shrink-swell potential is high. The root zone is restricted by the shale bedrock; however, some roots can penetrate the cleavage planes of the bedded shale. These soils generally are mildly alkaline in the surface layer and moderately alkaline below that.

In most areas, these soils are in native grasses and are used for grazing. In some some small areas where the slopes are 10 to 12 percent, they are used for alfalfa or as hayland. These soils have fair to poor potential for use as rangeland. They have very poor potential for cultivated crops, trees and shrubs in windbreaks, sanitary facilities, and building site development. These soils have fair potential for the development of habitat for rangeland wildlife and poor potential for recreation uses.

These soils are not suited to cultivated crops because of the slope and the shallowness over shale.

These soils are best suited to use as rangeland. Droughtiness and the hazard of erosion are the main limitations. The droughtiness is due to the low available water capacity of the soil and the loss of water through runoff. Maintaining an adequate cover of vegetation and ground mulch helps to prevent excessive soil loss and improves the moisture supply by reducing runoff and evaporation. Overgrazing the rangeland reduces the vegetative cover and causes deterioration of the plant community; the taller, more desirable grasses are replaced by less productive short grasses. Proper

Figure 11.—An area of Labu-Sansarc silty clays, 11 to 30 percent slopes. These soils are in native grasses and are used for grazing.

stocking, uniform grazing, deferred grazing, and a planned grazing system help to keep the rangeland and the soil in good condition.

If houses are constructed on these soils, foundations and footings should be designed to prevent structural damage caused by the shrinking and swelling of the soil. The underlying shale is relatively unstable and can cause slippage in wet periods. Drainage is needed around the housing site to prevent the soil from becoming saturated. These soils generally are not suited to use as septic tank absorption fields or sewage lagoons. The deeper, less sloping soils on the foot slopes or the broader ridgetops can be used for sewage lagoons.

The capability unit is VIe-4; the Labu soil is in the Clayey range site, and the Sansarc soil is in the Shallow Clay range site; these soils are in windbreak suitability group 10.

Lo—Loup fine sandy loam, 0 to 2 percent slopes. This is a deep, nearly level, poorly drained soil on bottom lands. This soil is occasionally flooded. The areas are long and narrow and range from 5 to 100 acres.

Typically, a 1-inch thick layer of partly decomposed leaves and stems overlies the surface soil. The surface soil is dark gray, friable fine sandy loam about 11 inches thick. The layer below that is light brownish gray, loamy fine sand about 3 inches thick. The underlying material, to a depth of 31 inches, is light gray fine sand. It overlies a buried layer of light gray loamy fine sand that extends to a depth of 37 inches. Below that, the soil is light gray fine sand that has many prominent yellow mottles. The underlying material is stratified and commonly has one or more buried layers of a darker colored, finer textured soil. In some areas the surface layer is loam, and in others it is fine sand.

Included in mapping are small areas of Albaton, Els, Elsmere, Inavale, Marlake, and Ord soils. Albaton soils are clayey. Els, Elsmere, and Ord soils are somewhat poorly drained and are in slightly higher positions on the

landscape than this Loup soil. Inavale soils are somewhat excessively drained; they are in the higher landscape positions or adjacent to deeply entrenched streams. Marlake soils are in the lower landscape positions and are covered with water throughout much of the year. The included soils make up 5 to 20 percent of this map unit.

Permeability is rapid. Because this soil has a high water table, usually it is saturated in wet periods. The seasonal water table is near the surface in wet years and at a depth of about 1.5 feet in dry years. The available water capacity is low, but plant roots generally extend to the water table. Runoff is slow, and water stands on the surface after a heavy rain or during periods of rapid snowmelt. The organic matter content is high. In some areas, because of the high content of lime in the surface layer, plants respond poorly to applications of phosphate fertilizer.

In most of the larger areas, this soil is used as native hay meadow. In many smaller areas, it is used as rangeland. This soil has very poor potential for cultivated crops. It generally has poor potential for trees in windbreaks. This soil has good potential for use as rangeland or hayland and for the development of habitat for wetland wildlife. It has poor potential for sanitary facilities, building site development, and recreation uses.

This soil generally is not suitable for cultivation because the wetness during the growing season precludes tillage.

This soil is used mainly as hayland or rangeland. In some years, haying is difficult because of extreme wetness. The slightly lower water table during the growing season is beneficial to big bluestem, indiangrass, and switchgrass. Fertilizer needs to be applied to increase the yield of hay. Stocking and haying should be limited to maintain the vigor of the grasses. Bogs can form in pastures that are grazed when the water table is at the surface. Proper stocking and deferred grazing help to maintain and increase grass productivity and to prevent the formation of bogs.

Only trees and shrubs that can tolerate the very high water table of this soil are suitable for use in windbreaks. Establishing trees is difficult, and special methods of planting may be necessary to prevent trees from being drowned out.

This soil is severely limited for use as septic tank absorption fields, for sewage lagoons, and for use as sites for houses and local roads and streets. The main limitations to these uses are wetness and flooding. Drainage and special designs are needed to overcome these limitations.

The capability unit is Vw-7, dryland; this soil is in the Wet Subirrigated range site; it is in windbreak suitability group 6.

Lp—Loup fine sandy loam, wet, 0 to 2 percent slopes. This is a deep, nearly level, very poorly drained soil on bottom lands. This soil is frequently flooded. The areas are long and narrow and range from 5 to 50 acres.

Typically, a one-inch thick layer of partly decomposed leaves and stems overlies the surface layer. The surface layer is dark gray, friable fine sandy loam about 7 inches thick. The subsurface layer is dark gray, very friable loamy fine sand about 7 inches thick. The underlying material, to a depth of 22 inches, is gray fine sand; to a depth of 60 inches, it is light brownish gray sand. The underlying material has reddish yellow mottles and strata of dark soil material. In some places, the surface layer is loam.

Included in mapping are small areas of Els, Elsmere, Marlake, and Ord soils. Els, Elsmere, and Ord soils are better drained than this Loup soil and are at a slightly higher elevation. Marlake soils are at a lower elevation and are covered with water throughout much of the year. The included soils make up 10 to 20 percent of this map unit.

Permeability is rapid; however, because the water table is high, the soil is saturated in wet periods. The seasonal water table is above the surface in wet years and at a depth of about 1 foot in dry years. The available water capacity is low, but plant roots generally extend to the water table. Runoff is slow, and water stands on the surface in wet periods. The organic matter content is high.

In most of the larger areas, this soil is used as native hay meadow. In many smaller areas, it is used as rangeland. This soil has very poor potential for cultivated crops. It generally has poor potential for trees in windbreaks. This soil has good potential for use as rangeland or hayland and for the development of habitat for wetland wildlife. It has poor potential for sanitary facilities, building site development, and recreation uses.

This soil generally is not suitable for cultivation because wetness during the growing season precludes tillage.

If this soil is used as hayland and rangeland, the forage cannot be harvested in some years because of wetness. In some areas, the hayland can be improved by using V-ditches to improve the surface drainage. The vegetation is mainly prairie cordgrass, reedgrasses, and tall sedges; the high water table has drowned out most of the bluestem, switchgrass, and indiangrass. Stocking and haying should be limited to maintain the vigor of the grass. The yield of forage can be increased by seeding the areas to reed canarygrass. Grazing livestock can damage the rangeland in wet periods. Bogs can form in pastures that are grazed when the water table is at the surface.

Only trees and shrubs that can tolerate the very high water table of this soil are suitable for use in windbreaks. Establishing trees is difficult in wet years, and special methods of planting may be required to prevent seedlings from being drowned out.

This soil is severely limited for use as septic tank absorption fields and for sewage lagoons because of the high water table and the frequent flooding. It is severely limited for use as sites for houses and for local roads

and streets because of wetness. Drainage is needed to overcome these limitations.

The capability unit is Vw-7, dryland; this soil is in the Wetland range site; it is in windbreak suitability group 6.

MaB—Manter loamy fine sand, 0 to 3 percent slopes. This is a deep, nearly level to gently undulating, well drained soil on uplands. The areas range from 5 to 100 acres.

Typically, the surface layer is dark grayish brown, loose loamy fine sand about 6 inches thick. The subsurface layer is brown, very friable loamy fine sand about 6 inches thick. The subsoil is about 10 inches thick. It is very friable, pale brown sandy loam in the upper part and friable, pale brown fine sandy loam in the lower part. The underlying material is light gray loamy fine sand. Sandstone is at a depth of about 48 inches. In some areas, the surface layer is fine sandy loam. In places, a buried layer of loamy soil material is in the underlying material.

Included in mapping are small areas of Duda, Dunday, Holt, Ipage, and O'Neill soils. Duda and Holt soils have sandstone at a depth of less than 40 inches. Dunday and Ipage soils are more sandy than this Manter soil. Ipage soils are in the lower positions on the landscape and are moderately well drained. O'Neill soils have sand and gravel at a depth of less than 36 inches. Except for the Ipage soils, these included soils are in the same landscape positions as this Manter soil. They make up 10 to 30 percent of this map unit.

Permeability is moderately rapid. Runoff is slow. The available water capacity is moderate. The organic matter content is low. Tilth is good, and the soil can be worked within a wide range in moisture content; however, the soil tends to be loose when it is dry.

About 75 percent of the acreage is used for cultivated crops or for alfalfa. In a few small areas, it is used for shelterbelts. The rest is native rangeland that is used for grazing or hay. This soil has fair potential for use as dryfarmed or gravity-irrigated cropland. It has good potential for cultivated crops if a sprinkler irrigation system is used. This soil has fair potential for use as rangeland and good potential for trees in windbreaks and for the development of habitat for openland wildlife. It has fair potential for recreation uses, sanitary facilities, and building site development.

This soil is suited to dryfarmed alfalfa, tame grasses, small grains, and corn. Soil blowing and droughtiness are severe hazards, even in years of normal rainfall. Soil blowing can be reduced and moisture conserved by maintaining a cover of crops, grass, or crop residue on the soil. Row crops should be limited in the cropping sequence. Stripcropping and field windbreaks also help to control soil blowing. Lime and phosphorus need to be applied if alfalfa is grown.

If this soil is irrigated, it is suited to corn, sorghum, small grains, and alfalfa. A sprinkler irrigation system, for example, the center-pivot sprinkler system, is the most suitable because it can provide the light, frequent applications of water needed on this soil. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

Using this soil as rangeland is effective in controlling soil blowing and water erosion. Overgrazing the rangeland or using improper haying methods reduces the vegetative cover and causes deterioration of the plant community. Proper range use, deferred grazing or haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil is suited to most trees in windbreaks. Site preparation and timely cultivation can increase seedling survival, reduce plant competition, and speed the growth of trees. Limited rainfall and soil blowing are limitations to planting trees on this soil. A cover crop between the rows of trees helps to reduce soil blowing.

This soil has moderate limitations to use as sites for houses and for roads and streets. The tendency of cutbanks to cave in is a slight limitation for shallow excavations. This soil has slight limitations to use as septic tank aborption fields. Seepage is a severe limitation for sewage lagoons. The sandy texture of the surface layer is a moderate limitation for camp areas and picnic areas.

The capability unit is IIIe-5, dryland, and IIIe-10, irrigated; this soil is in the Sandy range site; it is in windbreak suitability group 3.

MaC—Manter loamy fine sand, 3 to 6 percent slopes. This is a deep, gently sloping and undulating, well drained soil on uplands and the upper part of toe slopes. The areas range from 5 to 200 acres.

Typically, the surface layer is dark grayish brown, very friable loamy fine sand about 4 inches thick. The subsurface layer is grayish brown, friable fine sandy loam about 2 inches thick. The subsoil is about 11 inches thick. It is brown, friable sandy clay loam in the upper part and pale brown, friable fine sandy loam in the lower part. The underlying material is white loamy fine sand. Soft sandstone is at a depth of about 49 inches. In cultivated areas, the surface layer is lighter in color than is typical. In places, the surface layer is fine sandy loam or fine sand.

Included in mapping are small areas of Duda, Dunday, Holt, and O'Neill soils. Duda and Holt soils have sandstone at a depth of less than 40 inches. Dunday soils are more sandy than this Manter soil. O'Neill soils have sand and gravel at a depth of less than 40 inches. The included soils are in the same position on the landscape as this Manter soil. They make up 10 to 25 percent of this map unit.

Permeability is moderately rapid, and runoff is slow. The available water capacity is moderate. The organic matter content is low. Tilth is good, and the soil can be worked within a wide range in moisture content; however, the soil material at the surface commonly is loose when it is dry.

In most areas, this soil is used as native rangeland or hayland. In a few areas, it is used for alfalfa. In some areas, this soil is used as irrigated cropland. This soil has poor potential for use as dryfarmed or gravity-irrigated cropland. It has fair potential for crops if a sprinkler irrigation system is used. This soil has fair potential for use as rangeland and good potential for trees in windbreaks and for the development of habitat for openland wildlife. It has fair potential for recreation uses, sanitary facilities, and building site development.

This soil is only marginally suited to dryfarmed corn and sorghum. This soil generally is best suited to small grains and alfalfa because these crops grow and mature in spring when rainfall is highest. Soil blowing is a severe hazard and can destroy seedlings early in spring. Soil blowing can be reduced, moisture conserved, and the organic matter content and fertility maintained by maintaining a cover of crops, grass, or crop residue on the soil. Returning crop residue and adding barnyard manure to the soil help to improve fertility and the organic matter content.

If this soil is irrigated, it is suited to corn, sorghum, small grains, alfalfa, and tame grasses. A sprinkler irrigation system, for example, the center-pivot sprinkler system, is the most suitable because it can provide the light, frequent applications of water needed on this soil to prevent the excessive leaching of plant nutrients. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

Using this soil as rangeland is effective in controlling soil blowing and water erosion. However, overgrazing the rangeland or using improper haying methods reduces the vegetative cover and causes deterioration of the plant community. Proper range use, deferred grazing or haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil is suited to most trees in windbreaks. Site preparation and timely cultivation can increase seedling survival, reduce plant competition, and speed the growth of trees. Limited rainfall and soil blowing are limitations to planting trees on this soil. A cover crop between the rows of trees helps to reduce soil blowing.

This soil has moderate limitations to use as sites for houses and for roads and streets. The tendency of cutbanks to cave in is a slight limitation to shallow excavations. This soil has slight limitations to use as septic tank absorption fields. Seepage is a severe limitation for sewage lagoons. The sandy texture of the surface layer is a moderate limitation to camp areas and picnic areas.

The capability unit is IVe-5, dryland, and IVe-10, irrigated; this soil is in the Sandy range site; it is in windbreak suitability group 3.

MfC—Manter fine sandy loam, 2 to 6 percent slopes. This is a deep, gently sloping, well drained soil on uplands and toe slopes. The areas generally are elongated and range from 5 to 100 acres.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 10 inches thick. The subsoil is grayish brown, friable fine sandy loam about 11 inches thick. The underlying material is light gray loamy fine sand. In some areas, the surface layer is loamy fine sand. In places, sandstone is at a depth of 40 to 60 inches.

Included in mapping are small areas of Duda, Dunday, O'Neill, Tuthill, and Vetal soils. Except for the Vetal soils, the included soils are in positions on the landscape similar to those of the Manter soil. Dunday and Duda soils are more sandy than the Manter soil. O'Neill soils have sand and gravel at a depth of 20 to 40 inches. Tuthill soils have more clay in the subsoil. Vetal soils have a dark-colored surface layer that is more than 20 inches thick; they are in the lower positions on the landscape. The included soils make up 10 to 25 percent of this map unit.

Permeability is moderately rapid, and runoff is slow. The available water capacity is moderate. The organic matter content is low. Tilth is good, and the soil can be worked within a wide range in moisture content.

About two-thirds of the acreage is native rangeland. The rest is mainly used for crops in rotation with hay and pasture. In some areas, this soil is used as sprinkler-irrigated cropland, and in a few small areas, it is used for windbreaks. This soil has fair potential for dryfarmed cultivated crops. It has poor potential for crops if a gravity irrigation system is used and fair potential if a sprinkler system is used. This soil has fair potential for use as rangeland and for building site development. It has good potential for trees in windbreaks, for the development of habitat for openland wildlife, for recreation uses, and for use as septic tank absorption fields. This soil has poor potential for sewage lagoons.

This soil is suited to dryfarmed corn and sorghum. It generally is better suited to alfalfa, small grains, and tame grasses. Soil blowing is a moderate hazard, and water erosion is a slight hazard. This soil is droughty in years of below average rainfall. Conservation tillage that leaves crop residue on the surface, contour farming, stripcropping, and field windbreaks help to control erosion and conserve moisture.

If this soil is irrigated, it is suited to most of the crops commonly grown in the county. A sprinkler irrigation system, for example, the center-pivot sprinkler system, generally is the most suitable because it requires no land leveling and can provide the light, frequent applications of water needed on this soil. The same practices needed to control erosion in dryfarmed areas are needed on irrigated lands.

This soil is well suited to use as rangeland. Using this soil as rangeland is effective in controlling soil blowing and water erosion. However, overgrazing the rangeland or using improper haying methods reduces the vegetative cover, causes deterioration of the plant community, increases soil blowing, and creates small blowouts. Proper range use, deferred grazing and haying,

and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil is suited to trees in windbreaks; however, blowing needs to be controlled by maintaining a strip of sod or other vegetation between the rows of trees. Droughtiness and competition from grasses and weeds for moisture are limitations to seedling establishment. Only trees and shrubs that can tolerate the slightly sandy, somewhat droughty condition of this soil are suitable.

This soil is well suited to recreation uses and to use as septic tank absorption fields. Seepage is a limitation for sewage lagoons. If this soil is used for sewage lagoons, the bottom needs to be sealed. This soil is moderately suited to use as sites for houses. Because this soil is susceptible to frost heave, it has only fair suitability for use as a site for local roads and streets.

The capability unit is IIIe-3, dryland, and IIIe-5, irrigated; this soil is in the Sandy range site; it is in windbreak suitability group 3.

MkG—Mariaville-Keota silt loams, 15 to 60 percent slopes. This map unit consists of steep to very steep, well drained, shallow and moderately deep soils on the lower part of side slopes and on breaks along the Niobrara River and its tributaries. These soils formed in material that weathered from siltstone. The areas range from 20 to several hundred acres.

This unit is 40 to 70 percent Mariaville soil and 20 to 40 percent Keota soil. The Mariaville soil is on the steeper and more convex slopes, some of which have slips and catsteps. The Keota soil is less sloping than the Mariaville soil and generally is on plane slopes. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Mariaville soil is grayish brown, very friable silt loam about 4 inches thick. The layer below that is pale brown, very friable silt loam about 6 inches thick. The underlying material is very pale brown silt loam. Siltstone is at a depth of about 16 inches. The soil material is calcareous throughout. In places, sandy material from soils at a higher elevation has accumulated on the surface of this soil.

Typically, the surface layer of the Keota soil is gray, very friable silt loam about 5 inches thick. The layer below that is light brownish gray, friable silt loam about 7 inches thick. The underlying material is light gray silt loam. Siltstone is at a depth of about 36 inches. The soil material is calcareous throughout. In some areas, the surface layer is loam and is more than 6 inches thick. In places, this soil has a subsoil that has some accumulation of clay.

Included in mapping and making up 10 to 25 percent of this map unit are small areas of Munjor, Paka, Simeon, Tassel, and Vetal soils. Munjor soils are stratified and are on the bottom of canyons. Paka soils are more than 40 inches thick over the siltstone; they are on the lower part of concave slopes. Simeon soils are deep and sandy and are on ridgetops. Tassel soils are shallow over sandstone; they are on knolls and ridgetops. Vetal soils are deep and are on toe slopes.

Permeability in the Mariaville and Keota soils is moderate above the siltstone. Runoff is rapid. The available water capacity is low.

These soils are in native vegetation of grass and trees, mainly scattered pines. There are broad leaved trees along most drainageways. These soils are not suitable for cultivated crops or for trees or shrubs in windbreaks. They have fair to poor potential for use as rangeland. These soils have poor potential for recreation uses, building site development, and sanitary facilities. They have fair potential for the development of habitat for woodland and rangeland wildlife.

These soils are not suitable for cultivated crops because they are steep to very steep. In addition, the Mariaville soil is shallow over siltstone bedrock. These soils are best suited to use as rangeland. Water erosion is a hazard if the vegetation is destroyed or deteriorated. Because of the low available water capacity and rapid runoff, these soils are droughty. Maintaining an adequate vegetative cover helps to prevent erosion and improve the moisture supply by reducing runoff. Overgrazing the rangeland reduces the vegetative cover and causes deterioration of the plant community. Proper range use, deferred grazing, and a planned grazing system help to maintain or improve the condition of the rangeland. There are many potential sites for pond reservoirs on these soils.

These soils generally are not suitable for windbreaks. In some areas where there are native trees, these soils can be used for woodland grazing, for the development of wildlife habitat, and for recreation uses.

These soils are severely limited for use as sites for houses and for local roads because of the steepness of slopes and the moderate shrink-swell potential of the soil. They are not suitable for use as septic tank absorption fields or for sewage lagoons because of the steep slopes and the shallowness to bedrock. Some of the deeper, less sloping soils on foot slopes or on the broader ridgetops are suitable as sites for sewage lagoons.

The capability unit is VIIs-4; the Mariaville soil is in the Shallow Limy range site, and the Keota soil is in the Limy Upland range site; these soils are in windbreak suitability group 10.

Mm—Marlake loamy fine sand, 0 to 1 percent slopes. This is a deep, nearly level, very poorly drained soil in depressions or basins on valley floors and in low areas bordering lakes and streams. This soil is frequently flooded. The areas range from 2 to 30 acres.

Typically, a 2-inch thick layer of partly decomposed leaves and stems overlies the surface layer. The surface layer is dark gray, very friable loamy fine sand about 8 inches thick. The underlying material, to a depth of about

60 inches, is stratified light gray fine sand; the strata are 1 to 3 inches thick and consist of finer or coarser textured material. The underlying material, to a depth of 36 inches, has few fine yellowish brown mottles. Typically, the soil is calcareous in the upper few inches, but in places it is noncalcareous throughout. This soil is severely affected with alkali in places along the edge of the mapped areas.

Included in mapping and making up 5 to 15 percent of this map unit are small areas of Loup and Barney soils. These soils have a lower water table than this Marlake soil and are in slightly higher positions on the landscape.

Permeability is rapid, and the available water capacity is low. The soil is neutral to moderately alkaline. The organic matter content is high. Runoff generally is ponded. The seasonal water table is as much as 2 feet above the surface in wet years and about 1 foot below the surface in dry years.

In most areas, this soil is covered with a dense stand of water-tolerant plants such as cattails and rushes. It is used mainly as habitat for wetland wildlife. In dry years, the forage can be mowed for use as mulch. This soil has very poor potential for use as rangeland, for cultivated crops, and for trees and shrubs in windbreaks. It has good potential for the development of habitat for wetland wildlife. This soil has very poor potential for building site development, recreation uses, and sanitary facilities.

This soil is too wet for use as cultivated cropland, hayland, or rangeland. The vegetation consists mainly of rushes, cattails, reeds, willows, and other water-tolerant plants. In some places, V-ditches can be installed to improve surface drainage. If drainage is improved, grasses such as prairie cordgrass and reed canarygrass can be established. The excessive wetness prevents haying operations except in extremely dry years.

In most areas, this soil is too wet for trees and shrubs. In some areas, it can be used for recreational, wildlife, or forestation plantings of water-tolerant trees and shrubs that are planted by hand or by other special means.

This soil is severely limited for sanitary facilities and building site development because of wetness and the frequent flooding.

The capability unit is VIIIw-7; this soil was not assigned to a range site; it is in windbreak suitability group 10.

MnF—Meadin gravelly sandy loam, 3 to 30 percent slopes. This is a gently sloping to steep, excessively drained, gravelly soil on uplands, low ridges, slope breaks, and foot slopes. This soil is shallow over gravel. The areas range from 3 to 300 acres.

Typically, the surface layer is dark gray, loose, gravelly sandy loam about 7 inches thick. The layer below that is brown, loose, gravelly loamy sand about 4 inches thick. The underlying material, to a depth of 33 inches, is light brownish gray, very gravelly sand; to a depth of 60 inches, it is light gray sand. In some areas, erosion has exposed the underlying gravel.

Included in mapping are small areas of Anselmo, O'Neill, Simeon, and Valentine soils. Anselmo soils are deep, loamy soils on foot slopes. O'Neill soils are moderately deep and are along the broader ridgetops. Simeon soils are sandy throughout and have a thinner surface layer than this Meadin soil; they are on smooth ridgetops. Valentine soils are deep, sandy soils on low dunes. Included soils make up 5 to 10 percent of the map unit.

Permeability is rapid in the upper part of this soil and very rapid in the underlying material. The available water capacity is low. The organic matter content is low. Runoff is slow to rapid, depending on the slope. Because this soil is shallow over coarse sand and gravel, it is droughty and has a restricted root zone.

In most areas, this soil is used as native rangeland. It has poor potential for use as rangeland, hayland, or pasture. It has very poor potential for cultivated crops and for trees and shrubs in windbreaks. This soil has poor potential for use as sites for houses, for sanitary facilities, for recreation uses, and for the development of habitat for rangeland wildlife. It has fair to poor potential for use as road-construction material and is a fair source of aggregate.

This soil generally is not suitable for cultivation because of shallowness over sand and gravel, droughtiness, and the steepness of slopes.

This soil has fair suitability for most rangeland grasses; however, the production of grasses is low unless the range is very carefully managed to maintain the higher producing grasses. Overgrazing the rangeland reduces grass production, reduces the vegetative cover, and increases the hazard of erosion. Proper stocking rates and a planned grazing system help to maintain the vigor of grass. Livestock should be shifted to the more productive areas of the pasture to prevent damage to the sparse cover of vegetation on this soil. The invasion of sumac is a problem if this soil is used as rangeland. Mowing in the smoother areas and spraying in other areas help to control the invading brush.

This soil generally is not suitable for windbreaks mainly because of the restricted root zone and the low available water capacity. Water erosion is a hazard on the steeper slopes. In some areas, this soil can be used for growing eastern redcedar and ponderosa pines in shelterbelts. However, the trees need to be planted by hand. The survival rate will be low and growth very slow in the first few years.

This soil is moderately to severely limited for use as septic tank absorption fields and as sites for houses and for roads and streets because of the strong to moderately steep slopes. This soil is limited for sewage lagoons because of seepage. In some areas, contamination of the underground water supply is a hazard if this soil is used as a septic tank absorption field.

The capability unit is VIs-4; this soil is in the Shallow to Gravel range site; it is in windbreak suitability group 10.

Mu—Munjor fine sandy loam, 0 to 2 percent slopes. This is a deep, nearly level, well drained soil on

bottom lands. This soil is rarely flooded. The areas are long and narrow and range from 4 to 40 acres.

Typically, the surface layer is very friable, gray fine sandy loam about 6 inches thick. The underlying material, to a depth of about 36 inches, is gray, stratified fine sandy loam and loam; below that, it is light gray loamy fine sand. In some areas, this soil has layers of darker colored or coarser or finer textured soil material. In a few places, the surface layer is dark-colored to a depth of more than 7 inches. In some areas, calcareous material is at a depth of more than 10 inches.

Included in mapping are small areas of Barney, Boels, Els, and Inavale soils. Barney soils are poorly drained; they are at the lowest elevations, generally adjacent to the stream channel. Boels and Els soils are somewhat poorly drained; they generally are at a slightly lower elevation than this Munjor soil. Inavale soils have more sand and are less calcareous than this soil. The included soils make up 5 to 15 percent of this map unit.

Permeability is moderately rapid, and runoff is slow. The available water capacity is moderate. The organic matter content is moderately low. This soil has good tilth and can be worked within a wide range in moisture content.

About 65 percent of the acreage is farmland that is now used mainly for hay and as pasture. The rest is native grassland that has some scattered trees. In a few small areas, this soil is irrigated. This soil has good potential for use as dryfarmed or irrigated cropland. Most areas, however, are too small for irrigation development. This soil has good potential for hay, for use as pasture, for trees in windbreaks, and for the development of habitat for rangeland and openland wildlife. It has good potential for recreation uses except in areas where flooding is a hazard. This soil has poor potential for sanitary facilities and, in areas subject to flooding, for building site development.

This soil is well suited to dryfarmed corn, small grains, and grasses and legumes for hay and pasture. The droughtiness due to the sandy underlying material is a limitation to crops, especially during years of below average rainfall. If this soil is bare of vegetation, soil blowing is a moderate hazard. Maintaining a cover of crop residue or of legumes or grasses or both helps to maintain the organic matter content and fertility and to control soil blowing.

If this soil is irrigated, it is suited mainly to corn and alfalfa but can also be used for small grains or tame grasses. A gravity or sprinkler system of irrigation is suitable. This soil requires less frequent and lighter applications of water because of the coarse-textured underlying material. Land leveling is needed for best results if a gravity system is used. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

Using this soil as rangeland is effective in controlling soil blowing. Overgrazing the rangeland or using improper haying methods reduces the vegetative cover and causes deterioration of the plant community. Proper range use and deferred grazing or haying help to maintain or improve the condition of the rangeland and the soil.

This soil generally provides good sites for trees in field windbreaks, range or livestock windbreaks, and recreation or wildlife plantings. However, only trees and shrubs that can tolerate the slightly sandy, somewhat droughty condition of this soil are suitable. The main limitations to establishing trees are droughtiness and the severe hazard of soil blowing. Soil blowing can be controlled by maintaining a strip of sod or other vegetation between the rows of trees; the cultivation should be restricted to the tree rows.

The hazard of flooding is a limitation to the use of this soil as a site for houses or most sanitary facilities. Dikes, diversions, or ditches can be used to help overcome this limitation. If these structures cannot be built, sites at a higher elevation should be selected. This soil has fair suitability for use as septic tank absorption fields in areas where flooding is rare; however, seepage from the fields can pollute the local well water. If this soil is used for sewage lagoons, the bottom needs to be lined with less permeable soil material, chemical sealers, or impervious liners to control seepage. Low soil strength, frost action, and the hazard of flooding are limitations to the use of this soil as sites for roads and streets. Replacing the base material, elevating the roadbed, and constructing dikes, diversions, or ditches can help to overcome these limitations. This soil is suited to most recreation uses. It is not suited to use as camp areas because of the severe hazard of flooding.

The capability unit is IIe-3, dryland, and IIe-5, irrigated; this soil is in the Sandy Lowland range site; it is in windbreak suitability group 3.

OaB—O'Neill loamy fine sand, 0 to 3 percent slopes. This is a nearly level and gently undulating, well drained soil on uplands. It is moderately deep over sand and gravel. The areas are elongated and range from 10 to 100 acres.

Typically, the surface layer is very dark grayish brown, friable loamy fine sand about 7 inches thick. The subsoil is about 23 inches thick. It is grayish brown, friable sandy loam in the upper part and brown, very friable sandy loam in the lower part. The underlying material is very pale brown sand. In some places, a darker, loamy buried soil overlying gravelly sand is at a depth of about 20 inches. In some places, the plow layer is loamy sand.

Included in mapping are small areas of Dunday, Ipage, Jansen, Simeon, Meadin, and Valentine soils. Dunday soils are deep and sandy. Ipage soils are deep and sandy and have mottles within a depth of 40 inches. Jansen soils have a finer textured surface layer and subsoil than this O'Neill soil. Simeon and Valentine soils are deep, sandy soils on hummocks; they have a thinner surface layer than this O'Neill soil. Meadin soils are shallow over gravel. The included soils make up 5 to 25 percent of this map unit.

Runoff is slow. Permeability is moderately rapid in the subsoil and very rapid in the underlying material. The available water capacity is low. The organic matter content is moderately low. The soil material at the surface is loose when it is dry.

In most areas, this soil is in native grass. Some areas were once used for cultivated crops but are now in grass. This soil has poor potential for dryfarmed cultivated crops. It has fair potential for crops if a gravity irrigation system is used and good potential if a sprinkler system is used. This soil has fair potential for use as native rangeland and tame pasture, for trees and shrubs in windbreaks, and for recreation uses. It has good potential for building site development and poor potential for sanitary facilities. This soil has good potential for the development of habitat for openland wildlife and fair potential for rangeland wildlife.

This soil is only marginally suited to dryfarmed corn and sorghum. It generally is best suited to small grains and to alfalfa or grass because these crops grow and mature in spring when rainfall is plentiful. This soil is highly susceptible to soil blowing if exposed by erosion or tillage. Maintaining a cover of crop residue on the surface reduces soil blowing, conserves moisture, and helps to maintain the organic matter content and fertility of the soil.

If this soil is irrigated, it is suited to most crops commonly grown in the county. A sprinkler irrigation system is the most suitable because it provides the frequent, light applications of water needed on this soil. A gravity irrigation system can be used; however, it is necessary to limit the length of the runs because of the high water intake rate. If an excessive amount of water is applied, fertilizer will be leached to a depth below the plant roots. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

Using this soil as rangeland is effective in controlling soil blowing and water erosion. However, overgrazing the rangeland or using improper haying methods reduces the vegetative cover, causes deterioration of the plant community, increases soil blowing, and creates small blowouts. Proper range use, deferred grazing or haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil is suited to trees in windbreaks. Only drought-tolerant trees and shrubs are suitable for planting. Droughtiness and competition from grass and weeds for moisture are the main limitations to seedling establishment.

This soil is severely limited for use as sewage lagoons because of seepage. Sewage lagoons constructed on this soil need to be lined or sealed. This soil has slight limitations for use as septic tank absorption fields; local well water can be contaminated if absorption fields are improperly located. This soil is severely limited for shallow excavations because the walls of excavations are unstable and tend to cave in; the cutbanks need to be sloped to stabilize the excavations. Frost action and low soil strength are moderate limitations to the use of this soil for local roads and streets. If this soil is used for local roads and streets, a special design will be needed to overcome the low soil strength and to reduce damage caused by frost action.

The capability unit is IVe-5, dryland, and IIIe-14, irrigated; this soil is in the Sandy range site; it is in windbreak suitability group 5.

Oe—O'Neill fine sandy loam, 0 to 2 percent slopes. This is a nearly level, well drained soil on uplands and on some stream terraces. This soil is moderately deep over sand and gravel. The areas range from 5 to 100 acres.

Typically, the surface soil is dark grayish brown, very friable fine sandy loam about 13 inches thick. The subsoil is brown, friable sandy loam about 11 inches thick. The underlying material is stratified gravelly sand. In some areas, the surface soil is loam. In other areas, the original surface soil has been winnowed, and the present surface soil is lighter colored loamy fine sand. In places, the underlying gravelly sand is calcareous.

Included in mapping are areas of Jansen, Simeon, and Valentine soils. Jansen soils have more clay in the subsoil than this O'Neill soil. Simeon soils have coarse sand within a depth of 20 inches. Valentine soils are deep, sandy soils on hummocks. The included soils make up 5 to 10 percent of this map unit.

Permeability is moderately rapid above the gravelly sand and very rapid in the gravelly sand. Runoff is slow. The available water capacity is low. The organic matter content is moderately low. Tilth generally is good, and the soil is easy to till within a fairly wide range in moisture content. The zone is restricted by the gravelly sand.

This soil is used about equally as rangeland and cropland. In many areas the cropland is used for hay and pasture in rotation with other crops. This soil has fair potential for dryfarmed or gravity-irrigated cultivated crops. It has good potential for crops if a sprinkler irrigation system is used. This soil has fair potential for native or tame grasses, for trees and shrubs in windbreaks, and for the development of habitat for rangeland wildlife. This soil has good potential for building site development, recreation uses, and for the development of habitat for openland wildlife. It has poor potential for all sanitary facilities.

This soil can be used for dryfarmed corn, sorghum, small grains, and alfalfa. The low available water capacity of this soil is the main limitation. This soil generally is best suited to small grains and alfalfa because these crops mature in spring, when rainfall is plentiful. If this soil is used for cultivated crops, soil blowing is a hazard. A cropping system that includes conservation tillage and maintains a cover of vegetation on the soil most of the year reduces the hazard of soil blowing and conserves moisture.

If this soil is irrigated, it can be used for corn, sorghum, small grains, alfalfa, and tame grasses.

Because of the low available water capacity of this soil, applications of water need to be frequent and light. An automatic sprinkler system is the best method of irrigating this soil. A gravity irrigation system can be used; however, because the water intake rate is high, it will be necessary to limit the length of the irrigation runs. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

Using this soil as rangeland or hayland is effective in controlling soil blowing and water erosion. However, the rangeland should not be overgrazed. Proper range use, deferred grazing or haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil can be used for trees and shrubs in farmstead and feedlot windbreaks, range or livestock windbreaks, and recreation or wildlife plantings. However, only trees and shrubs that are very tolerant of droughtiness are suitable. Droughtiness and competition from grasses and weeds for moisture are the main limitations to seedling establishment. The hazard of soil blowing also is a limitation. Maintaining a strip of sod or other vegetation between the rows of trees and restricting the cultivation to the tree row can help to control soil blowing. Weeds can be controlled by chemical treatment.

This soil can be used as a site for houses and as septic tank absorption fields. However, because of the very rapid permeability of the underlying material, seepage from the absorption field can contaminate the underground water. If this soil is used for sewage lagoons, the bottom needs to be sealed to prevent seepage. Frost action and low soil strength are moderate limitations to local roads and streets. The base material needs to be strengthened and designed to reduce damage caused by frost action and low strength.

The capability unit is IIIe-3, dryland, and IIIe-9, irrigated; this soil is in the Sandy range site; it is in windbreak suitability group 5.

OeC—O'Neill fine sandy loam, 2 to 6 percent slopes. This is a gently sloping, well drained soil on uplands and on some stream terraces. This soil is moderately deep over sand and gravel. The areas are elongated and range from 3 to 30 acres.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 5 inches thick. The subsurface layer is dark gray, friable fine sandy loam about 2 inches thick. The subsoil is about 21 inches thick. It is grayish brown, friable, heavy fine sandy loam in the upper part and pale brown, very friable, light fine sandy loam in the lower part. There is some gravel in the subsoil. The underlying material, at a depth of 28 inches, is pale brown gravelly sand. In areas where this soil has been eroded, the plow layer extends into the subsoil. In places, the plow layer is loamy fine sand. In some places, the underlying material is calcareous.

Included in mapping are small areas of Anselmo, Jansen, Manter, and Simeon soils. These soils are in the same landscape positions as the O'Neill soil. Anselmo and Manter soils are deep. Jansen soils have a finer textured subsoil than the O'Neill soil. Simeon soils have coarse sand within a depth of 20 inches. These included soils make up 5 to 20 percent of this map unit.

Permeability is moderately rapid in the upper part of the soil and very rapid in the underlying material. Runoff is slow to medium. The available water capacity is low. The organic matter content is moderately low. The root zone is restricted below a depth of about 28 inches. This soil is easy to till within a wide range in moisture content.

More than half of the acreage is native rangeland. In many areas, this soil has at one time been used for cultivated crops and is now used as permanent hayland and pasture. In a few areas, the soil is used as dryfarmed cropland. In some areas it is used as sprinkler irrigated cropland. A few small areas are in shelterbelts. This soil has poor potential for use as dryfarmed or gravity-irrigated cropland. It has fair potential for crops if a sprinkler irrigation system is used. This soil has fair potential for use as rangeland or pasture, for trees and shrubs in windbreaks, and for the development of habitat for rangeland wildlife. It has good potential for the development of habitat for openland wildlife, for building site development, and for recreation uses. This soil has poor potential for all sanitary facilities.

This soil is only marginally suited to dryfarmed corn or sorghum. It generally is best suited to small grains and alfalfa or grass because these crops grow and mature in spring when rainfall is plentiful. This soil is highly susceptible to soil blowing if exposed by erosion or tillage. Maintaining crop residue on the surface reduces soil blowing, conserves moisture, and helps to maintain the organic matter content and fertility of the soil.

Where this soil is irrigated, the main crops are corn, grain sorghum, alfalfa, and tame grasses. Applications of irrigation water need to be frequent and light to prevent the leaching of plant nutrients. A sprinkler irrigation system is the most suitable on this soil. A gravity irrigation system is not suitable because the high water-intake rate makes it necessary to limit the length of irrigation runs. The same practice needed to control erosion in dryfarmed areas are needed on irrigated land,

Using this soil as rangeland is effective in controlling soil blowing and water erosion. However, overgrazing the rangeland or using improper haying methods reduces the vegetative cover, causes deterioration of the plant community, and can increase soil blowing. Proper range use, deferred grazing or haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil can be used for farmstead and feedlot windbreaks, range or livestock windbreaks, and recreation or wildlife plantings. Droughtiness and competition from grasses and weeds for moisture and limitations to seedling establishment. The hazards of soil blowing and water erosion also are a limitation. Erosion can be controlled by maintaining a strip of sod or other

vegetation between the rows of trees. The cultivation should be restricted to the tree rows. Weeds can be controlled by chemical treatment.

This soil can be used as a site for houses and as septic tank absorption fields. However, seepage from the absorption fields can contaminate the underground water. The walls of shallow excavations tend to cave in or slough; cutbanks need to be sloped to stabilize the excavations. If this soil is used for sewage lagoons, the bottom needs to be sealed to prevent seepage. Frost action and low soil strength are limitations to local roads and streets. The base material needs to be strengthened and the road graded to reduce damage caused by frost action and low strength.

The capability unit is IVe-3, dryland, and IVe-9, irrigated; this soil is in the Sandy range site; it is in windbreak suitability group 5.

OeD—O'Neill fine sandy loam, 6 to 9 percent slopes. This is a strongly sloping, well drained soil on short, uneven side slopes on uplands. This soil is moderately deep over sand and gravel. The areas range from 5 to 30 acres.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 8 inches thick. The subsurface layer is dark grayish brown, very friable sandy loam about 5 inches thick. The subsoil is about 13 inches thick. It is grayish brown, very friable sandy loam in the upper part and loamy sand that has some gravel in the lower part. The underlying material, at a depth of about 26 inches, is pale brown gravelly sand. In some areas, erosion has removed most of the dark surface layer. In places, the surface layer is loamy fine sand.

Included in mapping are small areas of Anselmo, Meadin, and Valentine soils. Anselmo and Valentine soils are deep. Meadin soils are shallow over gravel. Anselmo and Meadin soils are in the same landscape positions as the O'Neill soil. Valentine soils are sandy throughout; they are on hummocks or low dunes. The included soils make up 5 to 20 percent of this map unit.

Permeability is moderately rapid in the subsoil and very rapid in the underlying material. The available water capacity is low. Natural fertility is medium. Runoff is medium to rapid. The root zone is restricted below a depth of about 26 inches.

This soil is used mainly as native rangeland. In a few small areas, it is used for cultivated crops or as permanent hayland or pasture. This soil has very poor potential for dryfarmed crops. It has poor potential for crops if a gravity or sprinkler irrigation system is used. This soil has fair potential for native or tame grasses for trees and shrubs in windbreaks, and for the development of habitat for openland and rangeland wildlife. It has good potential for building site development and recreation uses and poor potential for sanitary facilities.

This soil generally is not suited to use as dryfarmed or irrigated cultivated cropland because of the low available water capacity and the slope. If this soil is irrigated, however, it is suited to alfalfa and to tame grasses. A sprinkler irrigation system is the most suitable on this soil. If this soil is tilled, runoff from a heavy rain or an irrigation system can cause severe gully erosion. Cultivation should be restricted to the lower part of slopes and to the deeper soils in this map unit. If this soil is used for crops, a cropping system that maintains a cover of crops, grass, or crop residue is necessary. Returning crop residue to the soil and adding barnyard manure increase the organic matter content and fertility of this soil.

Using this soil as rangeland is effective in controlling soil blowing and water erosion. However, overgrazing the rangeland or using improper haying methods reduces the vegetative cover, causes deterioration of the plant community, and can increase soil blowing. Proper range use, deferred grazing or haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil can be used for farmstead and feedlot windbreaks, range or livestock windbreaks, and recreation or wildlife plantings. Droughtiness and competition from grasses and weeds for moisture are limitations to seedling establishment. The hazards of soil blowing and water erosion also are a limitation. Erosion can be controlled by maintaining a strip of sod or other vegetation between the rows of trees. The cultivation should be restricted to the tree rows. Weeds can be controlled by chemical treatment.

This soil can be used as a site for houses and as septic tank absorption fields. However, seepage from the absorption fields can contaminate underground water. The walls of excavations tend to cave in or slough; cutbanks need to be sloped to stabilize the excavations. If this soil is used for sewage lagoons, the bottom needs to be sealed to prevent seepage. Frost action and low soil strength are limitations to local roads and streets. The base material needs to be strengthened and the road graded to reduce damage caused by frost action and low strength.

The capability unit is VIe-3, dryland, and IVe-9, irrigated; this soil is in the Sandy range site; it is in windbreak suitability group 5.

OhB—O'Neill-Meadin fine sandy loams, 0 to 3 percent slopes. This map unit consists of nearly level and gently undulating, well drained and excessively drained soils on uplands. These soils are shallow and moderately deep over sand and gravel. The areas range from 10 to several hundred acres.

This map unit is 40 to 60 percent O'Neill soil and 20 to 35 percent Meadin soil. The Meadin soil is slightly lower on the landscape than the O'Neill soil. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the O'Neill soil is dark grayish brown, very friable fine sandy loam about 7

inches thick. The subsoil is about 19 inches thick. It is dark brown, very friable sandy loam in the upper part and pale brown, very friable fine sandy loam in the lower part. The underlying material, at a depth of 26 inches, is very pale brown, noncalcareous coarse sand. In some areas, the surface layer is sandy loam or loamy fine sand. In places, the subsoil has some loam. In a few areas, the underlying sand, coarse sand, or gravelly sand is at a depth of more than 40 inches.

Typically, the surface layer of the Meadin soil is dark grayish brown, friable fine sandy loam about 3 inches thick. The subsurface layer is dark brown, friable sandy loam about 4 inches thick. The layer below that is grayish brown, friable, gravelly sandy loam about 5 inches thick. The underlying material, at a depth of 12 inches, is light brownish gray, very gravelly coarse sand. In some areas, the surface layer is thinner and coarser textured than is typical. In places, the underlying material is less gravelly than is typical.

Included in mapping and making up 10 to 30 percent of this map unit are small areas of Jansen, Simeon, and Valentine soils. Jansen soils are in the same landscape positions as the O'Neill soil but have more clay in the subsoil. Simeon soils are in the same landscape positions as the Meadin soil but have more sand throughout. Valentine soils are deep, sandy soils on hummocks.

In the O'Neill soil, permeability is moderately rapid in the subsoil and very rapid in the underlying material. In the Meadin soil, permeability is rapid in the upper part and very rapid in the underlying material. The available water capacity of the O'Neill and Meadin soils is low. The organic matter content is moderately low in the O'Neill soil and low in the Meadin soil. These soils have moderate to slow runoff. The root zone is restricted by the coarse gravelly material in these soils.

These soils are used mainly as native rangeland. In a few areas where these soils are intermingled with deeper soils, they are used for cultivated crops. These soils have poor potential for dryfarmed or gravity-irrigated cultivated crops. They have fair potential for crops if a sprinkler irrigation system is used. These soils have fair to poor potential for native or tame grasses for hay or grazing and fair to very poor potential for trees and shrubs in windbreaks. They have good potential for building site development and recreation uses and poor potential for sanitary facilities. The O'Neill soil has good potential for the development of habitat for openland wildlife, and the Meadin soil has poor potential. These soils have fair potential for the development of habitat for rangeland wildlife.

These soils are marginally suited to dryfarmed corn or sorghum. They generally are best suited to small grains and alfalfa or grass because these crops grow and mature in spring when rainfall is plentiful. These soils are highly susceptible to soil blowing if exposed by erosion or tillage. A cropping system that maintains a cover of crop residue on the surface reduces soil blowing, conserves moisture, and helps to maintain the organic matter content and fertility of these soils.

Where these soils are irrigated, the main crops are corn, grain sorghum, alfalfa, and tame grasses. Applications of irrigation water need to be frequent and light to prevent the leaching of plant nutrients. A sprinkler irrigation system is the most suitable on these soils; nevertheless, precautions need to be taken to control erosion. A gravity irrigation system is not suitable because the high water-intake rate makes it necessary to limit the length of irrigation runs.

Using these soils as rangeland is effective in controlling soil blowing and water erosion. However, overgrazing the rangeland or using improper haying methods reduces the vegetation cover, causes deterioration of the plant community, and can increase soil blowing. Proper range use, deferred grazing or haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

These soils can be used for farmstead and feedlot windbreaks, range or livestock windbreaks, and recreation or wildlife plantings. Droughtiness and competition from grasses and weeds for moisture are limitations to seedling establishment. The hazards of soil blowing and water erosion also are a limitation. Erosion can be controlled by maintaining a strip of sod or other vegetation between the rows of trees. The cultivation should be restricted to the tree rows. Weeds can be controlled by chemical treatment.

These soils can be used as sites for houses and as septic tank absorption fields. However, seepage from absorption fields can contaminate ground water. The walls of excavations tend to cave in or slough; cutbanks need to be sloped to stabilize the excavations. If these soils are used for sewage lagoons, the bottom needs to be sealed to prevent seepage. Frost action and low soil strength are limitations to local roads and streets. The base material needs to be strengthened and graded to reduce damage caused by frost action and low strength.

The capability unit is IVe-3, dryland, and IVe-14, irrigated; the O'Neill soil is in the Sandy range site and in windbreak suitability group 5; the Meadin soil is in the Shallow to Gravel range site and in windbreak suitability group 10.

OkD—O'Neill-Valentine complex, 1 to 9 percent slopes. This complex consists of very gently sloping to rolling, well drained to excessively drained soils on tablelands. The O'Neill soil is moderately deep over sand and gravel, and the Valentine soil is deep. The areas of this map unit range from 15 to 200 acres.

This unit is 35 to 70 percent O'Neill soil and 25 to 50 percent Valentine soil. The O'Neill soil is in the lower positions on the landscape, and the Valentine soil is on hummocks and low dunes. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the O'Neill soil is dark grayish brown, very friable sandy loam about 6 inches thick. The subsoil is brown, friable sandy loam about 15 inches thick. The underlying material, at a depth of about 21 inches, is pale brown coarse sand. In some areas, the surface layer is loam or loamy fine sand. In places, the underlying material has more gravel than is typical.

Typically, the surface layer of the Valentine soil is dark grayish brown, loose fine sand about 5 inches thick. The layer below that is grayish brown, loose fine sand about 8 inches thick. The underlying material, at a depth of 13 inches, is brown fine sand. In some areas, the surface layer is loamy fine sand. In places, this soil has a dark-colored loamy layer below a depth of 40 inches.

Included in mapping and making up 10 to 35 percent of this map unit are areas of Jansen, Meadin, and Simeon soils. Jansen soils are moderately deep over sand, coarse sand, or gravelly sand; they have more clay in the subsoil than O'Neill and Valentine soils. Meadin soils are shallow over sand and gravel. Simeon soils have more sand throughout than the O'Neill soil. These included soils generally are between the O'Neill and Valentine soils on the landscape.

Permeability of the O'Neill soil is moderately rapid in the subsoil and very rapid in the underlying material. The Valentine soil has rapid permeability throughout. The available water capacity of these soils is low. The organic matter content is moderately low. Runoff is slow. The root zone in the O'Neill soil is restricted by coarse underlying material.

These soils are used mainly as native rangeland. In a few small areas, they are used for cultivated crops or as permanent hayland and pasture. These soils have very poor potential for dryfarmed crops. They have poor potential for crops if a gravity or sprinkler irrigation system is used. These soils have fair potential for native or tame grasses, for trees and shrubs in windbreaks, and for recreation uses. They have good potential for building site development and poor potential for sanitary facilities. The O'Neill soil has good potential for the development of habitat for openland and rangeland wildlife, and the Valentine soil has fair potential.

These soils generally are not suited to row crops, either dryfarmed or irrigated, because of the low available water capacity and the slope. If these soils are irrigated, however, they are suited to alfalfa and to tame grasses. A sprinkler irrigation system is the most suitable on these soils. If these soils are tilled, soil blowing will be a severe hazard. Cultivation should be restricted to the lower part of slopes and to the deeper soils in this complex. If these soils are used for crops, a cropping system that maintains a cover of crops, grass, or crop residue is necessary. Returning crop residue to the soil and adding barnyard manure increase the organic matter content and fertility of these soils.

Using these soils as rangeland is effective in controlling soil blowing. However, overgrazing the rangeland or using improper haying methods reduces the vegetative cover, causes deterioration of the plant community, and can increase soil blowing. Proper range use, deferred grazing or haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

These soils can be used for farmstead and feedlot windbreaks, range or livestock windbreaks, and recreation or wildlife plantings. Droughtiness and competition from grasses and weeds for moisture are limitations to seedling establishment. The hazards of soil blowing and water erosion also are a limitation. Erosion can be controlled by maintaining a strip of sod or other vegetation between the rows of trees. The cultivation should be restricted to the tree rows. Weeds can be controlled by chemical treatment.

These soils can be used as sites for houses and as septic tank absorption fields. However, seepage from absorption fields can contaminate the underground water. The walls of excavations tend to cave in or slough; cutbanks need to be sloped to stabilize the excavations. If these soils are used for sewage lagoons, the bottom needs to be sealed to prevent seepage. Frost action and low soil strength are limitations to local roads and streets. The base material needs to be strengthened and graded to reduce damage caused by frost action and low strength.

The capability unit is VIe-3, dryland, and IVe-9, irrigated; the O'Neill is in the Sandy range site and in windbreak suitability group 5; the Valentine soil is in the Sands range site and in windbreak suitability group 7.

On—Onita silt loam, 0 to 1 percent slopes. This is a deep, nearly level, moderately well drained soil in swales on uplands. The areas are slightly elongated and range from 4 to 100 acres.

Typically, the surface soil is very dark gray, friable silt loam about 16 inches thick. The subsoil extends to a depth of 36 inches; it is firm, very dark grayish brown and dark grayish brown silty clay loam. The underlying material is brown, calcareous silt loam. In places, the underlying material has layers of darker soil material. In a few areas, sand and shale are below a depth of 40 inches.

Included in mapping are small potholes and small areas of Reliance silt loam. The Reliance soil is in slightly raised positions and is more subject to erosion than this Onita soil; it has a dark surface layer that is less than 20 inches thick. Inclusions make up 5 to 10 percent of this map unit.

Permeability is moderately slow. Runoff is slow. The available water capacity is high. The organic matter content is moderate. Because runoff is slow, the surface layer of this soil remains wet after a rain longer than that of surrounding soils. The shrink-swell potential in the subsoil is high.

This soil is used mainly for cultivated crops. In a few small areas, it is in native grass. This soil has good potential for the commonly grown cultivated crops, either

dryfarmed or irrigated. It has fair potential for native or tame grasses for grazing or hay. This soil has good potential for trees and shrubs in windbreaks, for recreation uses, and for the development of habitat for openland wildlife. It has poor potential for building site development and for use as septic tank absorption fields and good potential for sewage lagoons.

This soil is suited to dryfarmed corn, sorghum, small grains, alfalfa, and grass. Droughtiness is a slight hazard. Erosion is not a problem if this soil is used for cultivated crops. The main limitation to crops is excessive wetness after a rain. Terraces on the adjacent, higher lying soils help to divert runoff from this soil, thus reducing wetness. Returning crop residue or adding other organic material to the soil helps to maintain fertility, reduce surface crusting, and improve water infiltration.

If this soil is irrigated, removing or draining the excess irrigation water is the main concern of management. A border, furrow, or sprinkler irrigation system is suitable. The irrigation water can collect in swales and damage crops. Management also is needed to reduce or control runoff at the end of fields because water running into drainageways can cause severe gully erosion. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

This soil is suited to use as rangeland. Overgrazing the rangeland reduces the vegetative cover and causes deterioration of the plant community. Proper range use and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil is well suited to field windbreaks, farmstead and feedlot windbreaks, range or livestock windbreaks, and recreation or wildlife plantings. The high clay content of the subsoil makes this soil somewhat droughty for seedlings, and the growth of the trees may be only fair. Site preparation and eliminating the competition from grasses and weeds for moisture can improve the rate of growth and survival of adapted trees.

This soil is poorly suited to use as sites for houses and as septic tank absorption fields because of the moderate shrink-swell potential and low strength of the soil. Foundations and basement walls need to be designed to withstand the shrinking and swelling of the soil; the abutting soil material should be replaced with readily available sandy material. Septic tank absorption fields in this soil should be larger than normal because the movement of effluent in the subsoil is slow.

In some areas, field tile can be placed in the sandy underlying material to help overcome this limitation. This soil has slight limitations to sewage lagoons. It has fair potential for use as sites for local roads and streets; the base material needs to be strengthened to reduce damage to the road caused by frost action and shrinking and swelling.

The capability unit is IIC-1, dryland, and I-3, irrigated; this soil is in the Silty range site; it is in windbreak suitability group 4.

Or—Ord-Loup fine sandy loams, 0 to 2 percent slopes. This map unit consists of deep, nearly level, poorly drained to somewhat poorly drained soils on bottom lands and stream terraces and in upland valleys. These soils are occasionally flooded. The areas of this unit range from 3 to 100 acres.

This unit is 55 to 65 percent Ord soil and 25 to 35 percent Loup soil. The Loup soil is in the lower positions on the landscape. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Ord soil is calcareous, gray fine sandy loam about 12 inches thick. The layer below that is calcareous, friable, light gray loam about 12 inches thick. The underlying material, to a depth of about 36 inches, is light gray fine sandy loam; below that it is fine sand, loamy sand, or sand stratified with finer and coarser material. In some areas, the surface soil is loam or silt loam. In places, the soil is dark to a depth of less than 10 inches. In some areas, the soil is strongly alkaline.

Typically, the surface layer of the Loup soil is calcareous, dark gray, very friable fine sandy loam about 7 inches thick. The layer below that is calcareous, very friable, gray fine sandy loam about 7 inches thick. The underlying material, to a depth of 21 inches, is light brownish gray loamy sand; below that, it is very pale brown fine sand.

Included in mapping are small areas of Cass and Elsmere soils. Elsmere soils have more sand than the Ord soil, and Cass soils have better drainage. Cass and Elsmere soils are in the same positions on the landscape as the Ord soil or are slightly higher. They make up 5 to 15 percent of this map unit.

Permeability of the Ord and Loup soils is moderately rapid to rapid. Runoff is slow. The available water capacity above the water table is low. The organic matter content is moderate to high. The water table is at a depth of 0.5 foot to 1.5 feet in the Loup soil and 1.5 to 3.5 feet in the Ord soil. The high water table and slow runoff of these soils generally hinder cultivation in spring but are beneficial to plants during the growing season. The surface layer is friable and can be worked within a fairly wide range in moisture content.

In most areas, these soils are used as hayland. In a few areas, they are used as cropland or rangeland, and in a few small areas they are used for windbreaks. These soils have fair potential for cultivated crops, either dryfarmed or irrigated. They have good potential for native or tame grasses for hay or grazing. These soils have fair to poor potential for trees and shrubs in windbreaks, fair potential for recreation uses, and poor potential for sanitary facilities and building site development. The Ord soil has good potential for the development of habitat for openland or rangeland wildlife. The Loup soil has poor potential for the development of habitat for openland wildlife and fair potential for rangeland wildlife.

In dryfarmed areas, alfalfa is the main crop. These soils are only marginally suited to other crops commonly grown in the county because of the excessive wetness early in spring. The yield of alfalfa varies from year to year; in wet years the root zone is restricted by the water table and in dry years the water table provides subirrigation for this crop. If these soils are cultivated, soil blowing is a slight hazard. Shallow drains can be used to remove ponded water on these soils. If suitable outlets are available, tile drains can be used to lower the water table and control wetness. Crop residue on the surface helps to control soil blowing. Returning crop residue to the soil and applying fertilizer help to maintain fertility.

The Loup soil in this unit is a limitation to the use of these soils as irrigated cropland. If the Loup soil makes up more than 10 to 15 percent of an area to be irrigated, tillage will be difficult and irrigation water can become impounded. In other areas, these soils are more suitable for irrigation; they are best suited to corn, grass, and hay. A sprinkler or gravity irrigation system is suitable. The applications of irrigation water need to be frequent and light to prevent waterlogging and deep leaching of plant nutrients. If a gravity irrigation system is used, the length of irrigation runs need to be shorter than typical because of the coarse-textured underlying material. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

Using these soils as rangeland or hayland is effective in controlling soil blowing. However, overgrazing the rangeland or using improper haying methods reduces the vegetative cover and causes deterioration of the plant community. Grazing when the soil is too wet can cause surface compaction and hummocks, which make grazing or harvesting difficult. Proper range use, deferred grazing or haying, and restricted use during very wet periods help to maintain the plant community and keep the soils in good condition.

These soils generally are suitable for field windbreaks, feedlot windbreaks, range or livestock windbreaks, and recreation or wildlife plantings. The rate of survival and growth of trees and shrubs will be good if water-tolerant species are selected for planting. Establishing seedlings is difficult in wet years. The abundant and persistent herbaceous vegetation on these soils is a limitation to the establishment and maintenance of trees.

These soils are severely limited for building site development because of the occasional flooding and wetness. If houses are constructed on these soils, then need to be protected through the use of pilings or fill material. Wetness and flooding also are severe limitations to onsite sanitary disposal systems. Flooding, wetness, and frost action are severe limitations to roads and streets. If access roads need to be constructed, installing a drainage system and elevating the roadbed can help to prevent damage by flooding. The roadbed material can be mixed with additives or other material to reduce damage to the road caused by frost action.

These soils should not be used for camp areas because of the hazard of flooding. Wetness is a moderate limitation to picnic areas, playgrounds, and paths and trails.

The capability unit is IIIe-6, dryland, and IIIw-8, irrigated; the Ord soil is in the Subirrigated range site and in windbreak suitability group 2; the Loup soil is in the Wet Subirrigated range site and in windbreak suitability group 6.

Pf—Paka fine sandy loam, 0 to 2 percent slopes. This is a deep, nearly level, well drained soil on high terraces or on uplands. The areas range from 5 to 100 acres.

Typically, the surface layer is dark grayish brown, friable fine sandy loam about 7 inches thick. The subsoil is brown fine sandy loam in the upper part, pale brown fine sandy loam in the middle part, and very pale brown silty clay loam in the lower part. It is firm throughout and extends to a depth of about 40 inches. The underlying material is white siltstone. The lower part of the subsoil and the underlying material are calcareous. In some areas, the surface layer is loam or loamy fine sand. In areas where this soil is eroded, the plow layer extends into the subsoil. In some small areas, the soil is strongly alkaline. In other areas, the subsoil has a higher content of clay than is typical.

Included in mapping are small areas of Anselmo, Ipage, Loup, Mariaville, Ord, and Wewela soils. Anselmo soils are coarser textured throughout than the Paka soil, and they are higher on the landscape. They formed in loamy material. Ipage soils are sandy throughout. They are lower on the landscape and are more undulating. Loup soils are very poorly drained; they are in the lowest positions on the landscape. Mariaville soils are shallow over siltstone; they are on low, eroded ridges. Ord soils are somewhat poorly drained and are in lower positions on the landscape than the Paka soil. Wewela soils have more sand in the subsoil and are moderately deep over shale; they are in the same landscape positions as the Paka soil. The included soils make up 5 to 15 percent of this map unit.

Permeability is moderate, and runoff is slow. The available water capacity is high. The organic matter content is moderately low. The surface layer is friable, and the soil is easy to work within a wide range in moisture content.

This soil is used about equally for cultivated crops and for native grass. On most of the cropland, the crops are in rotation with hay and pasture. The native grassland is used mainly for grazing; in a few areas, it is used for hay. This soil has good potential for cultivated crops, either dryfarmed or irrigated. It has fair potential for native or tame grasses for grazing or hay. This soil has good potential for trees and shrubs in windbreaks and for the development of habitat for rangeland or openland wildlife. It has fair potential for building site development and sanitary facilities and good to fair potential for recreation uses.

This soil is well suited to dryfarmed corn, sorghum, small grains, and alfalfa. However, insufficient rainfall is a concern if this soil is dryfarmed. Soil blowing is a hazard if this soil is cultivated. Shelterbelts along field boundaries help to control soil blowing. Growing row crops in rotation with close-growing crops and leaving most of the crop residue on the surface help to improve the organic matter content of the soil and to control soil blowing.

If this soil is irrigated, it is best suited to corn and alfalfa. A gravity irrigation system that makes use of contour furrows or borders can be used on the lower part of slopes. A sprinkler system should be used on the higher, more irregular slopes. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

Using this soil as pasture or rangeland is effective in controlling soil blowing and water erosion. Overgrazing the rangeland reduces the vegetative cover and causes deterioration of the plant community. Proper range use and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil is well suited to field windbreaks, farmstead and feedlot windbreaks, range or livestock windbreaks, and recreation or wildlife plantings. However, only trees and shrubs that can tolerate the slightly sandy, somewhat droughty condition of this soil are suitable. Insufficient moisture and the severe hazard of soil blowing are the main limitations to establishing trees. Soil blowing needs to be controlled by maintaining a strip of sod or other vegetation between the rows of trees.

The moderate shrink-swell potential of this soil is a moderate limitation to use as a site for houses. Replacing the abutting soil material with readily available sandy material helps to prevent damage caused by shrinking and swelling. The moderate permeability of this soil is a limitation to use as septic tank absorption fields; however, this limitation generally can be overcome by increasing the size of the absorption area. The moderate depth to rock and seepage are moderate limitations to sewage lagoons. The bottom of the lagoon may need to be sealed with slowly permeable material. The low strength of this soil is a severe limitation to roads and streets. This limitation can be overcome by strengthening or replacing the base material.

The capability unit is IIe-3, dryland, and IIe-5, irrigated; this soil is in the Sandy range site; it is in windbreak suitability group 3.

Ph—Paka loam, 0 to 1 percent slopes. This is a deep, nearly level, well drained soil on high terraces and uplands. The areas are slightly elongated and range from 5 to 80 acres.

Typically, the surface soil is dark grayish brown, very friable loam about 14 inches thick. The subsoil extends to a depth of about 30 inches. It is grayish brown, friable clay loam in the upper part; pale brown, firm silty clay loam in the middle part; and light gray, very friable silt loam in the lower part. The underlying material is calcareous, white silt loam. Siltstone is at a depth of about 41 inches. In some areas, the surface soil is silt loam or fine sandy loam. In places, the siltstone is at a depth of less than 40 inches.

Included in mapping are small areas of Manter, Mariaville, and Wewela soils. Manter soils have more sand than this Paka soil. Mariaville soils are shallow over siltstone and are on the slightly higher knolls. Wewela soils are moderately deep over shale and have a sandy surface layer. Manter and Wewela soils are in the same landscape positions as the Paka soil. The included soils make up 5 to 15 percent of this unit.

Permeability is moderate and runoff is slow. The available water capacity is high. The organic matter content is moderate. In areas where the surface drainage is slowest, the soil tends to puddle.

In most areas this soil is used for cultivated crops or for crops in rotation with hay and pasture. This soil has good potential for cultivated crops, either dryfarmed or irrigated. It has good potential for trees and shrubs in windbreaks and for the development of habitat for openland or rangeland wildlife. It has fair potential for native or tame grasses for hay or grazing. This soil has fair to good potential for recreation uses and fair potential for building site development and sanitary facilities.

This soil is well suited to dryfarmed corn, alfalfa, sorghum, and tame grasses. However, insufficient rainfall is a concern if this soil is dryfarmed. Water erosion is a slight hazard. Soil blowing is a hazard if this soil is not adequately protected. Leaving the crop residue on the surface during tillage helps to reduce evaporation and to increase the moisture intake of the soil. Stripcropping and returning crop residue to the soil help to reduce soil blowing. Fertility is easy to maintain by adding commercial fertilizer and barnyard manure to the soil.

Where this soil is irrigated, corn is the main crop. This soil is also suited to alfalfa, sorghum, and tame grasses under an irrigation system. If this soil is irrigated, maintaining fertility and managing the irrigation water are the main management concerns. A border, furrow, or sprinkler irrigation system is suitable. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

This soil is well suited to use as rangeland. Using this soil as rangeland is effective in controlling erosion. However, overgrazing the rangeland reduces the vegetative cover and causes deterioration of the plant community. Proper range use, deferred grazing, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil is well suited to field windbreaks, farmstead windbreaks, range and livestock windbreaks, and recreation or wildlife plantings. Trees and shrubs that are moderately tolerant of droughtiness are suitable. Plant competition is the main limitation.

This soil has moderate limitations to use as sites for houses and for septic tank absorption fields and sewage

lagoons. Foundations and basement walls need to be designed to withstand the shrinking and swelling of the soil. Replacing the abutting soil material with sandy material helps to prevent damage caused by shrinking and swelling. If this soil is used for septic tank absorption fields, the size of the absorption area needs to be increased because of the moderate permeability of this soil. Local roads and streets need to be designed to prevent damage resulting from the low strength of the soil; the base material may need to be replaced or modified.

The capability unit is IIc-1, dryland, and I-4, irrigated; this soil is in the Silty range site; it is in windbreak suitability group 4.

PhB—Paka loam, 1 to 3 percent slopes. This is a deep, very gently sloping, well drained soil on high terraces and uplands. The areas are irregular in shape and range from 5 to 100 acres.

Typically, the surface soil is dark grayish brown, very friable loam about 14 inches thick. The subsoil extends to a depth of about 30 inches. It is grayish brown, friable clay loam in the upper part; pale brown, firm silty clay loam in the middle part; and light gray, friable silt loam in the lower part. The underlying material is white, calcareous silt loam. Soft siltstone is at a depth of 41 inches. In some areas, the siltstone is at a depth of less than 40 inches. In places, this soil has a plow layer of fine sandy loam.

Included in mapping are small areas of strongly alkaline soils. Also included are small areas of Els, Manter, and Wewela soils. Els soils are somewhat poorly drained, sandy soils in the lower positions on the landscape. Manter soils overlie sandy material, and Wewela soils are moderately deep over shale. Manter and Wewela soils are in the same positions on the landscape as the Paka soil. The included soils make up 5 to 15 percent of this map unit.

Permeability is moderate, and runoff is slow. The available water capacity is high. The organic matter content is moderate. The root zone is restricted by the high content of lime in the underlying material and by the soft siltstone at a depth of 41 inches. The shrink-swell potential is moderate.

In most areas, this soil is used for cultivated crops or for crops in rotation with hay and pasture. This soil has good potential for the commonly grown cultivated crops, either dryfarmed or irrigated. It has good potential for trees and shrubs in windbreaks and for the development of habitat for openland or rangeland wildlife. It has fair potential for native or tame grasses for hay or grazing. This soil has fair to good potential for recreation uses and fair potential for building site development and sanitary facilities.

This soil is well suited to dryfarmed corn, alfalfa, sorghum, and tame grasses. However, insufficient rainfall is a concern if this soil is dryfarmed. Water erosion is a slight hazard. Soil blowing is a hazard if this soil is not adequately protected. Leaving the crop residue on the surface during tillage helps to reduce evaporation and to increase the moisture intake of the soil. Stripcropping and returning crop residue to the soil help to reduce soil blowing.

Where this soil is irrigated, corn is the main crop. This soil is also suited to alfalfa, sorghum, and tame grasses under an irrigated system. If this soil is irrigated, maintaining fertility and managing the irrigation water are the main concerns of management. A border, furrow, or sprinkler system of irrigation is suitable. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

This soil is well suited to use as rangeland. Using this soil as rangeland is effective in controlling erosion. Overgrazing the rangeland reduces the vegetative cover and causes deterioration of the plant community. Proper range use, deferred grazing, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil is well suited to field windbreaks, farmstead windbreaks, range and livestock windbreaks, and recreation or wildlife plantings. Trees and shrubs that are moderately tolerant of droughtiness are suitable. Plant competition is the main limitation.

This soil has moderate limitations to use as sites for houses and for septic tank absorption fields and sewage lagoons. Foundations and basement walls need to be designed to withstand the shrinking and swelling of the soil. Replacing the abutting soil material with sandy material helps to prevent damage caused by shrinking and swelling. If this soil is used for septic tank absorption fields, the size of the absorption area needs to be increased because of the moderate permeability of the soil. Local roads and streets need to be designed to prevent damage resulting from the low strength of the soil; the base material may need to be replaced or modified.

The capability unit is IIe-1, dryland, and IIe-4, irrigated; this soil is in the Silty range site; it is in windbreak suitability group 4.

PmC—Paka-Mariaville loams, 3 to 6 percent slopes. This map unit consists of deep and shallow, gently sloping and undulating, well drained soils on uplands. These soils formed in material that weathered from or was deposited over siltstone. The areas range from 5 to 80 acres.

This unit is 40 to 60 percent Paka soil and 20 to 40 percent Mariaville soil. The Paka soil is on concave slopes, and the Mariaville soil is on convex slopes. In general, the Paka soil is in swales, and the Mariaville soil is on small ridges or hummocks. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Paka soil is dark grayish brown, very friable loam about 6 inches thick.

The subsurface layer is very dark grayish brown, friable loam about 2 inches thick. The subsoil is about 9 inches thick. It is grayish brown silty clay loam in the upper part and light brownish gray silt loam in the lower part; the soil is firm when moist. The underlying material, at a depth of 17 inches, is white silty loam. Weathered siltstone is at a depth of about 40 inches; it is more consolidated with depth. In a few areas, the siltstone is at a depth of less than 40 inches. In some areas, the surface layer is silt loam or fine sandy loam.

Typically, the surface layer of the Mariaville soil is dark grayish brown, friable silt loam about 6 inches thick. The layer below that is light gray, friable silt loam about 4 inches thick. The underlying material is white, weathered siltstone that is more consolidated with depth. The soil is calcareous throughout. In areas where this soil is eroded, the plow layer extends into the original underlying material. In some areas, the surface layer is loam or sandy loam and is more than 6 inches thick. In places, the siltstone is at a depth of more than 20 inches.

Included in mapping and making up 5 to 20 percent of this unit are small areas of Anselmo, Holt, Manter, and Wewela soils. Anselmo and Manter soils are deep, loamy soils on the higher ridges. Holt soils are in the higher positions on the landscape; they have sandstone at a depth of 20 to 40 inches. Wewela soils are in the lower positions on the landscape; they have shale at a depth of 20 to 40 inches.

Permeability is moderate above the siltstone and slow through the siltstone. The available water capacity is high in the Paka soil and low in the Mariaville soil. Runoff on these soils is medium. The root zone is slightly restricted by siltstone in the Paka soil and severely restricted in the Mariaville soil.

About 75 percent of the acreage has been cultivated; about half of this acreage is now used as permanent hayland and pasture. The rest of this map unit is native rangeland. These soils have fair potential for use as dryfarmed or sprinkler-irrigated cropland. They have poor potential for use as gravity-irrigated cropland. These soils have fair to poor potential for native or tame grasses. They have good to poor potential for trees and shrubs in windbreaks, fair potential for recreation uses, and good to fair potential for the development of habitat for rangeland or openland wildlife. These soils have fair potential for building site development and fair to poor potential for sanitary facilities.

These soils have fair suitability for dryfarmed corn, alfalfa, sorghum, small grains, and tame grasses. Water erosion is a moderate hazard, and soil blowing is a slight hazard. Terraces and conservation tillage that leaves crop residue on the surface help to control erosion and conserve moisture.

If these soils are irrigated, they are well suited to alfalfa and grasses; if erosion is controlled, they are also suited to corn and grain sorghum. A sprinkler irrigation system is the most suitable on these soils. If a gravity system of irrigation is used, heavy grading will be necessary, and terraces or benches will be needed to achieve a uniform distribution of water and to control erosion. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

These soils are suited to use as rangeland or pasture. Using these soils as rangeland or pasture is effective in controlling water erosion and soil blowing. However, overgrazing the rangeland or using improper haying methods reduces the vegetative cover and causes deterioration of the plant community. Proper range use, deferred grazing or haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil generally provides fair sites for trees in field windbreaks, farmstead and feedlot windbreaks, range or livestock windbreaks, and recreation or wildlife planting. Droughtiness and competition from weeds and grasses for moisture are the main limitations. The rate of survival and growth of moderately drought-resistant trees and shrubs is good. Water erosion is a hazard. Site preparation and timely cultivation are needed to insure the survival of seedlings.

The moderate shrink-swell potential of these soils is a moderate limitation to use as sites for houses. The soil material abutting foundations and basement walls needs to be replaced with sandy material. If these soils are used as septic tank absorption fields, the length of the absorption lines needs to be increased because of the moderate permeability of the soil. The shallowness to bedrock of the Mariaville soil is a limitation to sewage lagoons; sewage lagoons should be constructed on soils that are deeper to bedrock. Local roads and streets need to be designed to prevent damage resulting from the low strength of the soil; the base material may need to be replaced or modified.

The capability unit is IIIe-1, dryland, and IIIe-4, irrigated; the Paka soil is in the Silty range site and in windbreak suitability group 4; the Mariaville soil is in the Shallow Limy range site and in windbreak suitability group 10.

PmF—Paka-Mariaville loams, 11 to 30 percent slopes. This map unit consists of deep and shallow moderately steep and steep, well drained soils on side slopes on uplands. These soils formed in material that weathered from siltstone. The areas range from 10 to several hundred acres.

This unit is 35 to 50 percent Paka soil and 25 to 40 percent Mariaville soil. The Paka soil is on the smoother slopes and on the lower part of slopes; the Mariaville soil is on the steeper and more convex slopes (fig. 12). These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Paka soil is dark grayish brown, friable loam about 7 inches thick. The subsurface layer is grayish brown, friable silt loam about 3 inches thick. The subsoil is grayish brown, firm silty

Figure 12.—An area of Paka-Mariaville loams, 11 to 30 percent slopes. These soils have fair to poor potential for use as rangeland.

clay loam about 8 inches thick. The underlying material is light gray silt loam that grades to siltstone at a depth of more than 40 inches. In some areas, the surface layer is silt loam.

Typically, the surface layer of the Mariaville soil is dark grayish brown, friable loam about 4 inches thick. The layer below that is brown, friable silt loam about 3 inches thick. The underlying material, to a depth of 16 inches, is light gray silt loam. It is underlain by siltstone. In some areas, the surface layer is more than 6 inches thick. In places, the surface is broken by catsteps.

Included in mapping and making up 10 to 30 percent of this unit are small areas of Anselmo, Labu, Meadin, Reliance, and Tassel soils. Anselmo soils are on the smoother ridges and divides; they are coarser textured than the Paka and Mariaville soils. Labu soils have more clay than these soils; they are on the lower part of side slopes near the bottom of drainageways. Meadin soils are on the upper part of the slopes; they are shallow over sand and gravel. Reliance soils formed in loess and are on the smoother ridgetops. Tassel soils are shallow over sandstone; they are near the top of knolls and ridges.

Permeability is moderate. The available water capacity is high in the Paka soil and low in the Mariaville soil. Runoff on these soils is rapid.

In most areas, these soils are in native grass and are used as rangeland. There are a few trees along the

drainageways. In a few small areas, these soils were once cultivated but are now used as permanent grassland. These soils have very poor potential for cultivated crops. They have fair to poor potential for use as rangeland. These soils have very poor potential for trees and shrubs in windbreaks. They have fair to good potential for the development of habitat for rangeland wildlife and fair to poor potential for openland wildlife. These soils have poor potential for recreation uses, building site development, and sanitary facilities.

These soils are not suited to cultivated crops because of the strongly sloping to steep slopes and the shallowness over siltstone of the Mariaville soil.

These soils are best suited to use as rangeland. Water erosion is a hazard if the vegetation is destroyed or deteriorated. Because of the rapid runoff, these soils are droughty. Maintaining an adequate vegetative cover reduces runoff, thereby reducing erosion and improving the moisture-supplying capacity of the soil. Overgrazing the rangeland reduces the vegetative cover and causes deterioration of the plant community. Proper range use, deferred grazing and a planned grazing system help to maintain or improve the condition of the rangeland and the soil. There are many potential sites for pond reservoirs on these soils.

These soils generally are not suitable for windbreaks. In some areas, they can be used for recreational, wildlife, or forestation plantings of adapted trees or shrubs if the trees are planted by hand or by other special means.

These soils are severely limited for use as sites for houses because of the steep slopes and moderate shrink-swell potential of the soils. These soils are too steep and too shallow over bedrock for use as septic tank absorption fields or for sewage lagoons. Sewage lagoons can be constructed on some of the deeper, less sloping soils on the foot slopes or on the broader ridgetops. The steep slopes are a severe limitation to the construction of local roads.

The capability unit is VIe-1, dryland; the Paka soil is in the Silty range site, and the Mariaville soil is in the Shallow Limy range site; these soils are in windbreak suitability group 10.

RaB—Ree loam, 1 to 3 percent slopes. This is a deep, very gently sloping, well drained soil in upland valleys and on terraces above deeply entrenched drainageways. The areas generally are elongated and range from 10 to 80 acres.

Typically, the surface soil is dark grayish brown, friable loam about 13 inches thick. The subsoil is grayish brown, firm clay loam about 12 inches thick. The underlying material, to a depth of 54 inches, is light brownish gray, friable clay loam; below that, it is pale brown loamy sand. In some areas, the soil below a depth of 40 inches is fine sandy loam, loamy fine sand, loamy sand, or gravelly sand. In places, shale is below a depth of 4 feet. In some areas, the surface soil is silt loam or fine sandy loam.

Included in mapping are small areas of Jansen, Onita, and Wewela soils. Jansen soils are moderately deep over sand and gravel. Onita soils are in slight depressions and are moderately well drained. Wewela soils are moderately deep over shale. Jansen and Wewela soils are in positions on the landscape similar to those of the Ree soil. The included soils make up 15 to 25 percent of this map unit.

Permeability is moderate, and runoff is medium. The available water capacity is high. The surface layer is slightly acid to neutral, and the subsoil is neutral to mildly alkaline. The organic matter content is moderate. The surface layer is friable and is easy to work within a fairly wide range in moisture content.

In most areas, this soil is used for cultivated crops; in many areas, it is irrigated. This soil has good potential for the commonly grown cultivated crops, either dryfarmed or irrigated. It has fair potential for native or tame grasses. This soil has good potential for trees and shrubs in windbreaks, for recreation uses, and for the development of habitat for openland or rangeland wildlife. It has fair potential for building site development and sanitary facilities.

This soil is suited to dryfarmed corn, small grains, sorghum, and alfalfa and grasses for hay or pasture. If this soil is tilled, it is subject to soil blowing. Water erosion is a slight hazard. Conserving moisture and maintaining the organic matter content and fertility of the soil are the main concerns of management. Terraces and conservation tillage that leaves crop residue on the surface help to control erosion and conserve moisture. Alternating row crops with small grains or legumes and grasses in the cropping system helps to maintain the organic matter content and fertility of the soil and helps to control soil blowing.

If this soil is irrigated, it is suited to most of the crops commonly grown in the county. The main crops are corn and alfalfa. This soil is well suited to a sprinkler irrigation system. If a gravity irrigation system is used, some land leveling will generally be needed to achieve uniform distribution of water. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

This soil is well suited to use as rangeland. Using this soil as rangeland is effective in controlling erosion. However, overgrazing the rangeland reduces the vegetative cover and causes deterioration of the plant community. Proper range use, deferred grazing, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil is well suited to field windbreaks, farmstead windbreaks, range and livestock windbreaks, and recreation or wildlife plantings. Trees and shrubs that are moderately tolerant of droughtiness are suitable. Plant competition is the main limitation.

This soil has moderate limitations to use as sites for houses and for septic tank absorption fields and sewage lagoons. Foundations and basement walls need to be

designed to withstand the shrinking and swelling of the soil. Replacing the abutting soil material with sandy material helps to prevent damage caused by shrinking and swelling. If this soil is used as septic tank absorption fields, the size of the absorption area needs to be increased because of the moderate permeability of the soil. Local roads and streets need to be designed to prevent damage resulting from the low strength of this soil; the base material may need to be replaced or modified.

The capability unit is IIe-1, dryland, and IIe-3, irrigated; this soil is in the Silty range site; it is in windbreak suitability group 4.

Rb—Ree loam, clayey substratum, 0 to 2 percent slopes. This is a deep, nearly level, well drained soil on high terraces and in upland valleys. The areas range from 5 to 60 acres.

Typically, the surface soil is dark grayish brown, friable loam about 14 inches thick. The subsoil is about 17 inches thick. It is dark grayish brown, friable loam in the upper part; grayish brown, firm heavy loam in the middle part; and brown, friable sandy clay loam in the lower part. The underlying material, to a depth of 40 inches, is grayish brown sandy clay loam; below that, it is mixed shale and clay that has lime and gypsum crystals. Bedded shale is at a depth of 54 inches. In some areas, the surface soil is fine sandy loam. In places, the bedded shale is at a depth of less than 40 inches.

Included in mapping are small areas of Paka and Verdel soils. Paka soils are deep, silty soils that are in the same positions on the landscape as the Ree soil. Verdel soils are deep, clayey soils on upland toe slopes and in landscape positions similar to those of the Ree soil. The included soils make up 5 to 15 percent of this map unit.

Permeability is moderate to a depth of 40 inches and slow below that. The available water capacity is high. Runoff is slow. The shrink-swell potential is low in the surface soil, moderate in the subsoil, and high in the clayey underlying material. The organic matter content is moderate. This soil is easy to till because it has a loamy surface soil. It absorbs water readily but, because of the loamy subsoil and the clayey underlying material, it releases water slowly to plants. After a heavy rain, ponding is common in the depressions.

About 75 percent of the acreage is used for cultivated crops. The rest is mainly native grassland. This soil has good potential for cultivated crops, either dryfarmed or irrigated. It has fair potential for native or tame grasses. This soil has good potential for trees and shrubs in windbreaks, for recreation use, and for the development of habitat for rangeland and openland wildlife. It has fair potential for building site development and sanitary facilities.

This soil is suited to dryfarmed corn, small grains, sorghum, and alfalfa and grasses for hay or pasture. If this soil is tilled, it is subject to soil blowing. Water erosion is a slight hazard. In areas where shale outcrops at the surface, cultivation is difficult. Tillage should be kept to a minimum. Leaving most of the crop residue on the surface and including legumes or a mixture of grasses and legumes in the cropping system help to maintain the organic matter content and fertility of the soil and help to control soil blowing.

Where this soil is irrigated, corn is the main crop. This soil is also suited to alfalfa, sorghum, and tame grasses under an irrigation system. If this soil is irrigated, maintaining fertility and managing the irrigation water are the main management concerns. A border, furrow, or sprinkler irrigation system is suitable. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

This soil is well suited to use as rangeland. Using this soil as rangeland is effective in controlling erosion. Overgrazing the rangeland reduces the vegetative cover and causes deterioration of the plant community. Proper range use, deferred grazing, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil is well suited to field windbreaks, farmstead windbreaks, range and livestock windbreaks, and recreation or wildlife plantings. Trees and shrubs that are moderately tolerant of droughtiness are suitable. Plant competition is the main limitation.

This soil has moderate limitations to use as sites for houses and for septic tank absorption fields and sewage lagoons. Foundations and basement walls need to be designed to withstand the shrinking and swelling of the soil. Replacing the abutting soil material with material that has more sand helps to prevent damage caused by shrinking and swelling. If this soil is used as septic tank absorption fields, the size of the absorption area needs to be increased because of the moderate permeability of the soil. Local roads and streets need to be designed to prevent damage resulting from the low strength of the soil; the base material may need to be replaced or modified.

The capability unit is IIe-1, dryland, and IIe-3, irrigated; this soil is in the Silty range site; it is in windbreak suitability group 4.

ReC—Reliance silt loam, 2 to 6 percent slopes This is a deep, gently sloping, well drained soil on tablelands. The areas are irregular in shape and range from 8 to 80 acres.

Typically, the surface layer is dark grayish brown, firm silt loam about 5 inches thick. The subsurface layer is very dark gray, firm silt loam about 6 inches thick. The subsoil extends to a depth of 37 inches; it is brown, firm silty clay loam. The underlying material is brown silt loam; gravelly sand is at a depth of about 48 inches. In some areas where this soil is eroded, the plow layer extends into the subsoil, and the present surface layer is silty clay loam. In most areas, the soil is calcareous in the lower part of the subsoil or in the underlying material. In some areas, shale is at a depth of 40 to 60 inches.

Included in mapping are small areas of Anselmo, Jansen, Onita, and Ree soils. Anselmo, Jansen, and Ree soils have more sand than this Reliance soil. Jansen soils have sand and gravel at a depth of 20 to 40 inches. All these soils are in the same positions on the landscape as the Reliance soil. Onita soils are in swales; they are dark-colored to a depth of more than 20 inches. The included soils make up 5 to 10 percent of the map unit.

Permeability is moderately slow, and runoff is medium. The available water capacity is high. The organic matter content is moderate. The surface layer is friable and is easy to till if the soil is not too dry or too wet. The shrink-swell potential is moderate to high in the subsoil.

This soil is used mainly for cultivated crops. It has fair potential for use as dryfarmed or sprinkler-irrigated cropland. It has poor potential for crops if a gravity irrigation system is used. This soil has good potential for trees and shrubs in windbreaks and for the development of habitat for rangeland or openland wildlife. It has fair potential for native or tame grasses. This soil has poor potential for building site development, fair potential for sanitary facilities, and good to fair potential for recreation uses.

This soil is suited to dryfarmed corn, small grains, sorghum, and alfalfa and grasses for hay or pasture. If this soil is used for row crops, water erosion and soil blowing are hazards. Erosion can be controlled through the use of terraces, contour farming, grassed waterways, and mulch tillage that leaves most of the crop residue on the surface. Fertility can be maintained by adding commercial fertilizer and barnyard manure; soil tests should be used to determine the amount of fertilizer to apply.

If this soil is irrigated, it is well suited to alfalfa and grasses. If erosion is controlled, it is suited to corn and grain sorghum. A sprinkler irrigation system is suitable on this soil. Because of the slope, erosion resulting from rainfall water and surplus irrigation water is difficult to control. The rate of water application needs to be carefully controlled so as not to exceed the intake rate of the soil. A furrow and border irrigation system can be used on this soil if the land is leveled so that water erosion and runoff are kept to a minimum. Contour bench leveling is effective in controlling irrigation water. Runoff at the end of fields needs to be controlled or the water reused. Terraces, grassed waterways, and crop residue on the surface can control erosion. The fertility of the soil can be maintained or improved by adding barnyard manure and commercial fertilizer in accordance with soil tests.

This soil is suited to use as pasture or rangeland. Water erosion can be reduced on rangeland by retaining part of the yearly growth of grass after the grazing season.

This soil generally provides good sites for trees in windbreaks. The rate of survival and growth of adapted trees is good. Erosion, droughtiness, and competition from weeds and grasses for moisture are the main limitations. Site preparation and timely cultivation are needed to insure seedling survival.

This soil is severely limited for use as sites for houses mainly because of the high shrink-swell potential. Foundations and footings need to be designed to withstand the shrinking and swelling of the soil; tile drains can be installed, or the abutting soil material can be replaced with readily available sandy material. If this soil is used as septic tank absorption fields, the moderately slow permeability is a severe limitation, and the size of the absorption area needs to be larger than normal. This soil has slight limitations for sewage lagoons. It is poorly suited to local roads and streets because of its low strength and high shrink-swell potential; the base material may need to be replaced or modified.

The capability unit is IIIe-1, dryland, and IIIe-3, irrigated; this soil is in the Silty range site; it is in windbreak suitability group 4.

RoD—Ronson-Anselmo fine sandy loams, 6 to 9 percent slopes. This map unit consists of deep to moderately deep, strongly sloping, well drained soils on the side slopes of drainageways that extend into the uplands. The areas generally are elongated and range from 10 to 200 acres.

This map unit is 40 to 50 percent Ronson soil and 35 to 45 percent Anselmo soil. The Ronson soil is on the upper part of side slopes and in convex positions; it is moderately deep over sandstone. The Anselmo soil is on the lower part of side slopes and in concave positions. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Ronson soil is dark gray, very friable fine sandy loam about 8 inches thick. The subsoil is grayish brown, friable fine sandy loam about 8 inches thick. The underlying material is light gray fine sandy loam. Soft, weathered sandstone is at a depth of 30 inches. In some areas, the surface layer is loamy fine sand. In places, the subsoil has a slight accumulation of clay.

Typically, the surface soil of the Anselmo soil is dark grayish brown, very friable fine sandy loam about 12 inches thick. The subsoil is brown, very friable fine sandy loam about 18 inches thick. The underlying material is grayish brown fine sandy loam. In some areas, there are free carbonates at a depth of 40 inches or more.

Included in mapping are small areas of a gravelly soil on ridgetops and small areas of Valentine and Tassel soils. Valentine soils are in the higher hummocky areas and have more sand than the Ronson and Anselmo soils. Tassel soils are on the higher ridges and are shallow over sandstone. These included soils make up less than 15 percent of this map unit.

Permeability of the Ronson and Anselmo soils is moderately rapid. Runoff is medium. The organic matter

content is moderately low. The available water capacity is moderate to low. Tilth is good, and the soil is easy to till within a wide range in moisture content.

About one-third of the acreage is used for cultivated crops. The rest is mainly rangeland. These soils have poor potential for the commonly grown cultivated crops. They have fair potential for use as rangeland. These soils have fair to good potential for trees and shrubs in windbreaks. They have good potential for recreation uses and for the development of habitat for openland and rangeland wildlife. These soils have fair potential for building site development and poor potential for sanitary facilities.

These soils are poorly suited to dryfarmed corn. They have fair suitability for dryfarmed wheat, spring grains, and grasses and legumes for hay and pasture. If these soils are used for cultivated crops, soil blowing and water erosion are hazards. Terraces, minimum tillage, stubble mulching, stripcropping, and contour farming help to control soil blowing and water erosion and to conserve moisture. Returning crop residue to the soil helps to maintain or improve the organic matter content and fertility of the soil and to increase the rate of water intake.

If these soils are sprinkler-irrigated, they have fair suitability for corn and for grasses and legumes for hay and pasture. If these soils are used for cultivated crops, soil blowing and water erosion are hazards. Minimum tillage and maintaining a cover crop on the soil help to reduce erosion. Returning crop residue to the soil and applying fertilizer or barnyard manure help to maintain fertility.

Using these soils as rangeland is effective in controlling erosion. However, overgrazing the rangeland reduces the vegetative cover, reduces grass production, and causes deterioration of the plant community. Proper stocking and a planned grazing system help to maintain the vigor of the grass.

These soils are suited to trees in windbreaks. The limited rainfall and the hazards of water erosion and soil blowing are limitations to planting trees. Erosion can be reduced by planting trees on the contour and by using a cover crop between the rows of trees. The undesirable grasses and weeds need to be controlled. Site preparation, timely cultivation, and the use of selected herbicides increase the rate of survival and growth of trees.

These soils are moderately limited for use as sites for houses and as septic tank absorption fields because of the moderate depth over sandstone, the hazard of seepage, and the steepness of slopes. These soils have fair potential for local roads and streets; the road base needs to be designed to reduce damage caused by frost action.

The capability unit is IVe-3, dryland, and IVe-9, irrigated; these soils are in the Sandy range site; the Ronson soil is in windbreak suitability group 5, and the Anselmo soil is in windbreak suitability group 3.

RoF—Ronson-Anselmo fine sandy loams, 9 to 30 percent slopes. This map unit consists of deep to moderately deep, moderately steep to steep, well drained soils on the side slopes of drainageways that extend into the uplands. The areas generally are elongated and range from 10 to 200 acres.

This unit is 50 to 60 percent Ronson soil and 30 to 45 percent Anselmo soil. The Ronson soil is on the upper part of side slopes and in convex positions; it is moderately deep over sandstone. The Anselmo soil is on the lower part of side slopes and in concave positions. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the surface soil of the Ronson soil is dark grayish brown, very friable fine sandy loam about 11 inches thick. The subsoil is gray and very pale brown, light loose fine sandy loam about 15 inches thick. The underlying material is white loamy sand that weathered from sandstone. Soft, weathered sandstone is at a depth of 30 inches or more. In some areas, the surface soil is loamy fine sand. In a few areas, the soil is calcareous at a depth of 18 inches.

Typically, the surface soil of the Anselmo soil is very friable, grayish brown fine sandy loam about 12 inches thick. The subsoil is gray, very friable fine sandy loam about 10 inches thick. The underlying material is light olive gray loamy fine sand. In some places, soft sandstone is at a depth below 40 inches. In places, the surface soil is loamy fine sand.

Included in mapping are small areas of a gravelly soil on ridgetops and small areas of Valentine and Tassel soils. Valentine soils are in hummocky areas and have more sand than the Ronson and Anselmo soils. Tassel soils are on ridges and the upper part of side slopes. They are shallow over sandstone. The included soils make up less than 15 percent of this map unit.

Permeability of the Ronson and Anselmo soils is moderately rapid. Runoff is medium. The available water capacity is moderate to low. The organic matter content is moderately low.

These soils are used mainly as rangeland. There are scattered trees in some areas. These soils have very poor potential for cultivated crops. They have fair potential for use as rangeland and for the development of habitat for openland wildlife. These soils have fair to very poor potential for shrubs and trees in windbreaks. They have good potential for the development of habitat for rangeland wildlife. These soils have poor potential for sanitary facilities, building site development, and recreation uses.

These soils are poorly suited to cultivated crops mainly because of the moderately steep to steep slopes.

Using these soils as rangeland is effective in controlling erosion. However, overgrazing the rangeland reduces the vegetative cover, reduces grass production, increases the hazard of erosion, and causes the invasion of undesirable weeds and woody plants. Proper stocking

and a planned grazing system help to maintain the vigor of the grass.

These soils are poorly suited to trees in windbreaks. Because of the severe hazard of erosion, site preparation and cultivation are restricted, and these soils generally are suitable only for conifers. In most areas, these soils are not suitable for machine planting.

These soils are moderately to severely limited for use as sites for houses and as septic tank absorption fields mainly because of the steepness of slopes. However, the land can be benched for small building sites, and septic tank absorption fields can be run on grade across the slope. If roads and streets are constructed on these soils, structures may be needed to prevent erosion of the road grade and side ditches.

The capability unit is VIe-3, dryland; these soils are in the Sandy range site; they are in windbreak suitability group 10.

RtB—Ronson-Tassel fine sandy loams, 0 to 3 percent slopes. This map unit consists of moderately deep and shallow, nearly level to gently undulating, well drained soils on uplands. The areas range from 5 to more than 200 acres.

This unit is 40 to 60 percent Ronson soil and from 30 to 50 Tassel soil. The Ronson soil is in swales and on the higher undulations. The Tassel soil is on the lower undulations. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the surface soil of the Ronson soil is very friable, grayish brown fine sandy loam about 13 inches thick. The layer below that is friable, light gray fine sandy loam about 5 inches thick. The underlying material is white loamy sand that has fragments of weathered sandstone. Consolidated sandstone is at a depth of about 25 inches. In some areas, the subsoil has an accumulation of clay. In other areas, the surface soil is loamy fine sand. There generally are intermittent stone lines in the transitional layer.

Typically, the surface layer of the Tassel soil is very friable, dark grayish brown and grayish brown fine sandy loam about 7 inches thick. The underlying material is light grayish brown fine sandy loam that has fragments of sandstone; it is calcareous at a depth of about 13 inches. Weakly cemented sandstone is at a depth of about 17 inches. In some areas, small stones are on the surface of the soil. In a few areas, the bedrock is harder, noncalcareous quartzite.

Included in mapping and making up 10 to 15 percent of this unit are small areas of Valentine soils and areas of wetland or subirrigated soils. Valentine soils are on the higher hummocks. They are deep and sandy. The wetland or subirrigated soils are in depressions where the underlying sandstone is saturated with water.

Permeability of the Ronson and Tassel soils is moderately rapid. The available water capacity is low. Runoff is slow to medium. The root zone is restricted at a depth of 16 to 30 inches by the sandstone; however, some roots can penetrate the deeper cracks in the sandstone. The soil is moderately alkaline throughout. The organic matter content is low.

In most areas, these soils are used as native rangeland. A few areas of these soils are in sprinkler-irrigated cropland. These soils have poor potential for the commonly grown cultivated crops if the land is dryfarmed or if a gravity irrigation system is used. They have fair potential for cultivated crops if a sprinkler irrigation system is used. These soils have fair to poor potential for use as rangeland, poor potential for trees and shrubs in windbreaks, and fair potential for the development of habitat for openland or rangeland wildlife. They have good potential for most recreation uses, fair potential for building site development, and poor potential for sanitary facilities.

These soils are poorly suited to dryfarmed cultivated crops. They can be used for grasses and alfalfa for hay or pasture. The main limitations to crops are the shallowness to bedrock and the low available water capacity.

These soils also are poorly suited to cultivated crops if a sprinkler irrigation system is used. Because of the shallowness to bedrock and low available water capacity of the soil, the applications of irrigation water need to be frequent. Minimum tillage and a cover crop help to reduce erosion. Returning crop residue to the soil and applying fertilizer or barnyard manure help to maintain fertility. The high content of calcium carbonate and the moderate alkalinity of the soils will adversely affect some crops.

Using these soils as rangeland is effective in controlling erosion. However, overgrazing the rangeland reduces the vegetative cover, reduces grass production, and increases the hazard of erosion. Proper stocking and a planned grazing system help to maintain the vigor of the grass.

These soils are not well suited to windbreaks because of the shallowness to sandstone and the low available water capacity. Only conifers should be planted unless special care can be provided. Machine planting is hindered by the shallowness of the soil. In some areas, the soils are too shallow to support trees.

These soils are poorly suited to use as septic tank absorption fields because of the shallowness to sandstone and the hazard of seepage. If a septic system needs to be installed, a site where the sandstone is at its maximum depth should be selected. These soils generally are not suitable for sewage lagoons. These soils are limited for use as sites for houses because of the difficulty of excavating for footings or basements. A suitable material will be needed for landscaping the building site. If roads and streets are constructed on these soils, cut and fill material will be needed for the road grade. In addition, the roadbanks and side ditches will require revegetation to prevent erosion.

The capability unit is IVe-3, dryland, and IVe-14, irrigated; the Ronson soil is in the Sandy range site and

in windbreak suitability group 5; the Tassel soil is in the Shallow Limy range site and in windbreak suitability group 10.

SaG—Sansarc silty clay, 20 to 40 percent slopes. This is a shallow, steep to very steep, well drained soil on uplands. It is on narrow ridges, sharp slope breaks, and the upper part of side slopes of some drainageways. The areas generally are irregular in shape and range from 10 to 80 acres.

Typically, the surface layer is dark grayish brown, friable silty clay about 4 inches thick. The underlying material is calcareous; it is grayish brown and light brownish gray clay. Light gray bedded shale is at a depth of 14 inches. In some areas, the shale is exposed at the surface.

Included in mapping are small areas of Labu and Schamber soils and areas of stony soils. These included soils make up 5 to 20 percent of this map unit. Labu soils are less sloping than the Sansarc soil and are more than 20 inches deep to bedded shale. Schamber soils formed in calcareous gravel and chert that mantle the shale; they are on ridgetops and blufflike side slopes. The stony soils are in a few small areas on ridges and side slopes; the stone fragments are sandstone, quartzite, or mudstone and range in size from coarse chert to boulders.

Permeability is slow. Runoff is very rapid, and the available water capacity is very low. The shrink-swell potential is high. The soil is mildly alkaline or moderately alkaline throughout. The root zone generally is restricted by the bedded shale; some roots can penetrate the shale.

In most areas, this soil is in native grass and is used for grazing. This soil has very poor potential for cultivated crops. It has poor potential for use as rangeland, for the development of wildlife habitat, for building site development, for recreation uses, and for sanitary facilities. This soil has very poor potential for trees in windbreaks.

This soil is not suited to cultivated crops because it is steep to very steep and is shallow over bedrock.

This soil is best suited to use as rangeland. Water erosion is a hazard if the vegetation is destroyed or deteriorated. This soil is droughty because it has a very low available water capacity and very rapid runoff. Maintaining an adequate vegetative cover reduces runoff, thereby reducing erosion and improving the moisture-supplying capacity of the soil. Overgrazing the rangeland reduces the vegetative cover and causes deterioration of the plant community. Proper range use, deferred grazing, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil. There are many potential sites for pond reservoirs on this soil.

This soil generally is not suited to windbreaks. In some areas, it can be used for recreational, wildlife, or forestation plantings of adapted trees or shrubs if the trees are planted by hand or by other special means.

This soil is severely limited for use as sites for houses mainly because of the steep slopes and the high shrink-swell potential. These soils are not suitable for use as septic tank absorption fields or for sewage lagoons because of the steep slopes and the shallowness to bedrock. Sewage lagoons generally can be constructed on some of the deeper, less sloping soils on foot slopes or on the broader ridgetops. The steep slopes are a severe limitation to use as sites for local roads.

The capability unit is VIIw-4; this soil is in the Shallow Clay range site; it is in windbreak suitability group 10.

ScF—Schamber gravelly sandy loam, 11 to 30 percent slopes. This is a steep soil that is shallow over chert and gravel. It is on ridgetops and in blufflike areas along drainageways. The areas are elongated or oval and range from 5 to 25 acres.

Typically, the surface layer is dark grayish brown, very friable gravelly sandy loam about 4 inches thick. The underlying material, to a depth of 18 inches, is grayish brown, very gravelly sandy loam; below that, it is very pale brown, very gravelly loamy sand.

Included in mapping are areas of Labu and Sansarc soils. These soils make up 15 to 20 percent of this map unit. Labu and Sansarc soils formed in weathered shale; they are on the lower part of slopes. Labu soils have bedded shale at a depth of 20 to 40 inches. Sansarc soils have bedded shale within a depth of 20 inches.

Permeability is rapid, and the available water capacity is very low. The organic matter content is low. Runoff is rapid. The soil is moderately alkaline throughout.

This soil is mainly in native grass and is used for grazing. It has very poor potential for cultivated crops and for trees and shrubs in windbreaks. It has poor potential for use as rangeland, for the development of habitat for wildlife, for building site development, for recreation uses, and for sanitary facilities.

This soil is best suited to use as rangeland. Droughtiness is the main limitation to this use. This soil is droughty because it has low available water capacity and rapid permeability. Grass production is limited by the low fertility and low available water capacity of this soil. The number of livestock needs to be reduced in years of low rainfall to protect the vegetative cover and prevent deterioration of the plant community; unless this step is taken, the taller, more desirable grasses will be replaced by less productive short grasses and weeds. Stocking at the proper rate, uniformly distributing livestock by placing salt or by cross fencing, and using a planned grazing system help to keep the rangeland and the soil in good condition.

This soil is not suited to cultivated crops because of the steep slopes and the shallowness over gravel.

This soil generally is not suited to windbreaks because of the restricted root zone and low available water capacity. In addition, water erosion is a hazard on the steeper slopes. In some areas, this soil can be used for eastern redcedar and ponderosa pine in shelterbelts.

The trees need to be planted by hand. The rate of survival is low and growth very slow in the first few years.

This soil is severely limited for building site development and for use as septic tank filter fields because of the steepness of slopes. It is not suitable for sewage lagoons because of seepage. In some areas, contamination of underground water is a hazard if this soil is used as a septic tank absorption field.

The capability unit is VIs-4; this soil is in the Shallow to Gravel range site; it is in windbreak suitability group 10.

SmF—Simeon-Manter-Ronson complex, 6 to 17 percent slopes. This map unit consists of strongly sloping and moderately steep, well drained to excessively drained soils on upland side slopes. The Simeon soil has coarse sand within a depth of 20 inches, the Manter soil is deep, and the Ronson soil is moderately deep over weathered sandstone. In most areas, the landscape is dissected by a series of shallow drainageways and low ridges. The areas of this map unit range from 10 to several hundred acres.

This complex is 30 to 45 percent Simeon soil, 25 to 35 percent Manter soil, and 15 to 20 percent Ronson soil. The Simeon soil is on the upper part of side slopes. The Manter soil is on the smoother and lower part of side slopes. The Ronson soil is on side slopes just below the Simeon soil in areas where the weathered sandstone is near the surface. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Simeon soil is dark grayish brown, very friable loamy fine sand about 5 inches thick. The layer below that is grayish brown, very friable loamy fine sand about 7 inches thick. The underlying material is light gray sand that is 1 to 2 percent gravel. In places, the underlying material is loamy sand or fine sand. In some areas, the surface layer is more than 10 inches thick.

Typically, the surface layer of the Manter soil is grayish brown, loose loamy fine sand about 6 inches thick. The subsurface layer is dark grayish brown, very friable fine sandy loam about 5 inches thick. The subsoil extends to a depth of about 26 inches. It is grayish brown and pale olive fine sandy loam. The underlying material is pale yellow fine sandy loam. Noncalcareous sandstone is at a depth of 41 inches. In places, the surface layer is fine sandy loam. In some areas, the subsoil is sandy clay loam or loam.

Typically, the surface layer of the Ronson soil is dark grayish brown, very friable loamy fine sand about 5 inches thick. The layer below that is grayish brown, loose fine sand about 7 inches thick. The underlying material is light grayish brown fine sand. A buried surface layer of grayish brown fine sandy loam is at a depth of 21 inches. Weathered sandstone that crushes to loamy sand is at a depth of 35 inches. In some areas, the sandstone is closer to the surface. In other areas, the soil above the sandstone is loamy fine sand.

Included in mapping and making up 15 to 20 percent of this unit are small areas of Holt, Ipage, Jansen, Meadin, and O'Neill soils. Holt soils have sandstone at a depth of less than 40 inches and have more clay in the subsoil; they are in the same landscape positions as the Ronson soil. Ipage soils are in low areas and are moderately well drained. Jansen and O'Neill soils are moderately deep over sand and gravel and are in the same landscape positions as the Manter and Simeon soils. Jansen soils have more silt and clay in the subsoil than the Manter soil. Meadin soils are shallow over gravel; they are on the upper part of side slopes or on ridgetops.

Permeability is rapid in the Simeon soil. It is moderately rapid in the Ronson and Manter soils. Water is often perched above the heavy subsoil and the sandstone. The available water capacity is low in the Manter and Ronson soils and very low in the Simeon soil. Runoff on these soils is slow. The organic matter content is moderately low to low.

In most areas, these soils are used as native rangeland. In a few small areas, they are used as sprinkler-irrigated cropland and for windbreaks. These soils have very poor potential for dryfarmed cultivated crops. They have poor potential for cultivated crops if an irrigation system is used. These soils have fair to poor potential for use as rangeland, fair to very poor potential for trees and shrubs in windbreaks, and fair to good potential for the development of habitat for openland and rangeland wildlife. They have fair potential for building site development and recreation uses. These soils have poor potential for sanitary facilities.

These soils generally are not suited to use as dryfarmed cropland. Where these soils are now or have at one time been cultivated, rangeland can be reestablished by planting warm-season native grasses. To establish the rangeland grasses, seedbed preparation, cover crops, adapted seeds, and weed control are needed.

These soils are poorly suited to use as irrigated cropland because of the strongly sloping to moderately steep slopes. The runoff of excess irrigation water or rainwater can cause severe erosion. Erosion on these soils can be reduced by growing close-sown crops such as alfalfa and grass and by restricting cultivation to areas where the slopes are less than 10 percent.

These soils are best suited to use as rangeland. Droughtiness and the severe hazards of soil blowing and water erosion are limitations. Establishing grass on these soils is effective in controlling soil blowing and water erosion. However, overgrazing the rangeland reduces the vegetative cover, causes deterioration of the plant community, and results in severe gully erosion on the steep slopes. Proper range use, deferred grazing, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

These soils generally are too droughty, too sandy, and too steep for trees in windbreaks. In some areas, they

can be used for recreational, wildlife, or forestation plantings of adapted species.

These soils are moderately limited for building site development because of the steepness of slopes. Excavations or fill material will be needed to provide a suitable site for houses that do not have a basement. Houses that have a basement can be designed to complement the slope, or the slope can be modified by grading. If local roads and streets are constructed, cuts and fills or a design that complements the slope may be needed. These soils are severely limited for shallow excavations because the walls of excavations tend to cave in or slough; cutbanks should be sloped to stabilize the excavations. Septic tank absorption fields should not be installed on slopes of more than 15 percent; on the lower part of slopes, drain trenches can be installed on the contour to insure that effluent is dispersed throughout the absorption field. If an absorption field is installed in an unsuitable location, the local ground water can be contaminated by seepage. These soils are severely limited for sewage lagoons because of seepage and the steepness of slopes. They are severely limited for recreation uses because of the steep slopes and the sandiness of the soils.

The capability unit is VIe-5, dryland, and IVe-9, irrigated; the Simeon soil is in the Shallow to Gravel range site and in windbreak suitability group 10; the Manter soil is in the Sandy range site and in windbreak suitability group 3; the Ronson soil is in the Sandy range site and in windbreak suitability group 5.

SvF2—Simeon-Valentine fine sands, 6 to 17 percent slopes, eroded. This map unit consists of deep, strongly sloping and moderately steep, excessively drained soils on upland side slopes and along terrace breaks. Eroded gullies draining runoff from the higher elevations dissect many areas of the landscape; they are 5 to 20 feet deep and 15 to 50 feet wide. The areas of this unit range from 10 to 100 acres.

This map unit is 40 to 50 percent Simeon soil and 35 to 50 percent Valentine soil. The Simeon soil is along ridges and on the upper part of side slopes. The Valentine soil is on the lower part of slopes or adjacent to small drainageways. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Simeon soil is grayish brown, loose fine sand about 8 inches thick. The next layer is pale brown, loose sand about 10 inches thick. The underlying material is very pale brown sand. In places, layers of gravel and of fine sand are in the underlying material. There are a few light yellowish brown mottles below a depth of 40 inches.

Typically, the surface layer of the Valentine soil is grayish brown, loose fine sand about 7 inches thick. The next layer is dark brown, loose fine sand about 11 inches thick. The underlying material is light gray fine sand. In places, sandstone or shale is at a depth below 40 inches. In a few areas, the surface layer is loamy sand or loamy fine sand.

Included in mapping and making up 5 to 20 percent of this map unit are small areas of Meadin, O'Neill, and Wewela soils. Meadin soils have more gravel than the Simeon and Valentine soils. O'Neill soils are moderately deep over sand and gravel, and Wewela soils are moderately deep over shale. Meadin and O'Neill soils are on the upper part of slope breaks, and Wewela soils are near the bottom of drainageways.

Permeability of the Simeon and Valentine soils is rapid. The available water capacity is low. The organic matter content is low. Runoff is slow to very slow. The soils are mildly acid to neutral in the upper part. In the Simeon soil, the root zone is somewhat restricted by sand and coarse sand.

In most areas, these soils are in native grass and are used as rangeland. They have very poor potential for cultivated crops. These soils have fair to poor potential for use as rangeland. They have fair to very poor potential for trees and shrubs in windbreaks and fair potential for the development of habitat for rangeland wildlife. These soils have fair potential for building site development and poor potential for sanitary facilities and recreation uses.

These soils are not suited to cultivation because of the coarse texture of the soils and the strongly sloping to moderately steep slopes. If the native grass cover on these soils is removed, soil blowing and water erosion will be severe hazards.

These soils are best suited to use as rangeland. Droughtiness and the severe hazards of soil blowing and water erosion are limitations. Maintaining the grass on these soils is effective in controlling soil blowing and water erosion. However, overgrazing the rangeland reduces the vegetative cover, causes deterioration of the plant community, and results in severe gully erosion on the steep slopes. Proper range use, deferred grazing, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

These soils generally are too droughty, too sandy, and too steep for trees in windbreaks. In some areas, they can be used for recreational, wildlife, or forestation plantings of adapted species if the trees are planted by hand.

These soils are moderately limited for building site development because of the steepness of slopes. Excavations or fill material will be needed to provide a suitable site for houses that do not have a basement. Houses that have a basement can be designed to complement the slope, or the slope can be modified by grading. If local roads and streets are constructed, cuts and fills or a design that complements the slope may be needed. These soils are severely limited for shallow excavations because the walls of excavations tend to cave in or slough; cutbanks should be sloped to stabilize the excavations. Septic tank absorption fields should not be installed on slopes of more than 15 percent; on the

lower part of slopes, drain trenches can be installed on the contour to insure that effluent is dispersed throughout the absorption field. If an absorption field is installed in an unsuitable location, the local ground water can be contaminated by seepage. These soils are severely limited for sewage lagoons because of seepage and the steepness of slopes. They are severely limited for recreation uses because of the steep slopes and the sandiness of the soils.

The capability unit is VIs-4, dryland; the Simeon soil is in the Shallow to Gravel range site and in windbreak suitability group 10; the Valentine soil is in the Sands range site and in windbreak suitability group 7.

SwB—Simeon-Valentine loamy sands, 0 to 3 percent slopes. This map unit consists of deep, nearly level and gently undulating, excessively drained soils on stream terraces and uplands. The areas range from 10 to 200 acres.

This unit is 50 to 75 percent Simeon soil and 20 to 40 percent Valentine soil. The Simeon soil is in nearly level positions or in swales between low hummocks. The Valentine soil is on hummocks. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Simeon soil is grayish brown, very friable loamy sand about 5 inches thick. The next layer is light brownish gray, very friable loamy sand about 13 inches thick. The underlying material is very pale brown coarse sand in the upper part and light gray sand in the lower part. In places, a thin layer of loamy material underlain by thin layers of gravel is in the underlying material. In a few areas there are mottles below a depth of 40 inches.

Typically, the surface layer of the Valentine soil is grayish brown, loose loamy sand about 6 inches thick. The next layer is brown, loose fine sand about 8 inches thick. The underlying material is pale brown fine sand. In many areas the dark surface layer is more than 10 inches thick.

Included in mapping and making up 5 to 20 percent of this map unit are small areas of Ipage, Meadin, and O'Neill soils. Ipage soils are in the lower areas and have mottles within a depth of 40 inches. Meadin soils are in similar or slightly higher positions on the landscape and are shallow over gravel. O'Neill soils are in the same landscape positions as the Simeon soil; they are moderately deep over sand and gravel.

Permeability of the Simeon and Valentine soils is rapid. The available water capacity is low. The organic matter content is low. Runoff is very slow. The soils are mildly acid to neutral in the upper part. In the Simeon soil, the root zone is somewhat restricted by sand.

In most areas, these soils are in native grass and are used as rangeland. They have been cultivated only in a few small areas. These soils have very poor potential for dryfarmed cultivated crops. They have poor potential for cultivated crops if a gravity or sprinkler system of irrigation is used. These soils have fair to poor potential for use as rangeland. They have fair to very poor potential for trees and shrubs in windbreaks and fair potential for the development of habitat for rangeland wildlife. These soils have good potential for building site development. They have poor potential for sanitary facilities and recreation uses.

These soils generally are not suited to dryfarmed cultivated crops. Where these soils are now cultivated or where the vegetation has deteriorated to weeds and annual grasses, rangeland can be established by planting warm-season native grasses. To establish the rangeland grasses, seedbed preparation, a cover crop, adapted seeds, and weed control are needed.

If these soils are irrigated, tame grasses, small grains, and alfalfa are the most suitable crops. If good management practices are used, corn and sorghum also can be grown. Soil blowing is a hazard. A sprinkler system of irrigation, for example, the center-pivot system, is the most suitable on these soils. The soil requires frequent applications of water. Maintaining a cover of crop residue on the surface, keeping tillage to a minimum, and applying fertilizer help to control soil blowing and maintain fertility.

These soils are best suited to use as rangeland. Maintaining a cover of grass on these soils is effective in controlling soil blowing. However, overgrazing the rangeland or using improper haying methods reduces the vegetative cover, causes deterioration of the plant community, increases soil blowing, and creates small blowouts. Proper range use, deferred grazing or haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil. The small blowouts on these soils can be converted to rangeland by shaping and fencing to exclude livestock and by mulching and reseeding.

These soils generally are too droughty and too sandy for trees in windbreaks. Some plantings can be made in areas where the Valentine soil is the dominant soil. In some areas, these soils can be used for recreational, wildlife, or forestation plantings of drought-tolerant trees and shrubs if special methods of planting are used.

These soils provide good sites for houses, roads and streets, and septic tank absorption fields. They are limited for shallow excavations because the walls of excavations tend to cave in; cutbanks need to be sloped to stabilize the excavations. These soils are severely limited for sewage lagoons because of seepage, which can cause contamination of ground water; however, the bottom of sewage lagoons can be sealed with impervious material to prevent seepage. The sandiness of these soils is a moderate limitation to most recreation uses.

The capability unit is VIs-4, dryland, and IVs-14, irrigated; the Simeon soil is in the Shallow to Gravel range site and in windbreak suitability group 10; the Valentine soil is in the Sands range site and in windbreak suitability group 7.

TaF—Tassel loamy fine sand, 3 to 30 percent slopes. This is a shallow, well drained soil on slope breaks, narrow ridgetops, and side slopes on uplands. The areas range from 5 to 40 acres in size.

Typically, the surface layer is dark grayish brown, very friable loamy fine sand about 5 inches thick. The subsurface layer is grayish brown, very friable fine sandy loam about 4 inches thick. The underlying material is light gray loamy sand that grades to white sandstone at a depth of about 13 inches. In some areas, the sandstone is at a depth of 20 to 30 inches. In places, the surface layer is loam or fine sandy loam.

Included in mapping are small areas of Valentine soils and small areas of sandstone outcrops. Valentine soils are deep, sandy soils on hummocks. Sandstone outcrops on the steep slope breaks and eroded ridges. Inclusions make up 10 to 20 percent of this map unit.

Permeability is rapid. The available water capacity is low. The organic matter content is low. Runoff is medium to rapid. In areas of sandstone outcrops, runoff is very rapid, and the root zone is restricted. Some roots penetrate the fissures and cracks in the sandstone and the pockets of deep sand.

This soil is mainly in native grass and is used for grazing. It has very poor potential for cultivated crops. This soil has poor potential for use as rangeland. It also has poor potential for building site development, recreation uses, sanitary facilities, and the development of habitat for wildlife. This soil has very poor potential for trees and shrubs in windbreaks.

This soil is not suited to cultivated crops because it is shallow over sandstone and is strongly sloping to steep.

This soil is best suited to use as rangeland. Water erosion is a hazard if the vegetation is destroyed or has deteriorated. Because of the rapid runoff, this soil is droughty. Maintaining an adequate vegetative cover reduces runoff, thereby reducing erosion and improving the moisture-supplying capacity of the soil. Overgrazing the rangeland reduces the vegetative cover and causes deterioration of the plant community. Proper range use, deferred grazing, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil generally is not suited to windbreaks. In some areas, it can be used for recreational, wildlife, or forestation planting of adapted trees and shrubs that are planted by hand or by other special means.

This soil is severely limited for use as sites for houses mainly because of the steep slopes and shallowness over sandstone. The steep slopes and shallowness over bedrock also are limitations to the use of this soil for septic tank absorption fields and sewage lagoons. Suitable sites for sewage lagoons generally can be constructed on some of the deeper, less sloping soils on foot slopes or on the broader ridgetops. The steep slopes are a severe limitation to local roads.

The capability unit is VIs-4, dryland; this soil is in the Shallow Limy range site; it is in windbreak suitability group 10.

TdE—Tassel-Duda complex, 3 to 15 percent slopes. This map unit consists of shallow and moderately deep, gently sloping and moderately steep, well drained soils on uplands. The areas range from 5 to 200 acres.

This map unit is 50 to 70 percent Tassel soil and 15 to 30 percent Duda soil. The Tassel soil is on the upper part of slopes and on ridges. The Duda soil is on the lower part of slopes and in swales. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Tassel soil is calcareous, grayish brown, very friable fine sandy loam that has some small chips of sandstone; it is about 4 inches thick. The next layer is white and light brownish gray, friable fine sandy loam that has small chips of sandstone; it is about 7 inches thick. Calcareous sandstone is at a depth of about 11 inches. In places, the surface layer is loam, sandy loam, or loamy fine sand.

Typically, the surface layer of the Duda soil is dark grayish brown, very friable loamy fine sand about 6 inches thick. The next layer is grayish brown, very friable loamy fine sand about 6 inches thick. The underlying material is pale olive and light gray fine sand. Consolidated sandstone is at a depth of 39 inches. The underlying material is calcareous. In some areas, the surface layer is fine sandy loam or fine sand. In places, the subsoil has accumulations of clay.

Included in mapping are small areas of Anselmo, Dunday, Manter, and Valentine soils. Anselmo and Manter soils are deep and loamy. Dunday and Valentine are deep and sandy. Anselmo, Manter, and Dunday soils are between the Duda and Tassel soils on the landscape. Valentine soils are on hummocks or small dunes. The included soils make up 15 to 25 percent of this map unit.

Permeability in the Tassel and Duda soils is moderately rapid. Runoff is medium to rapid. The available water capacity and the organic matter content are low. The root zone generally is restricted to a depth of less than 30 inches.

These soils are used mainly as native rangeland. In a few small areas, they are used for alfalfa or tame grasses. In some small areas, these soils are in association with deeper soils that are used as irrigated cropland. These soils have very poor potential for cultivated crops. They have fair to poor potential for use as rangeland. These soils have fair to very poor potential for trees and shrubs in windbreaks. They have poor to fair potential for building site development, recreation uses, sanitary facilities, and the development of habitat for wildlife.

These soils generally are not suited to cultivated crops because of the steepness of slopes and the shallowness of the soils. Cultivation of these soils results in severe water erosion and soil blowing.

These soils are best suited to use as rangeland. The main limitations are droughtiness and the hazard of erosion. Maintaining an adequate cover of vegetation and ground mulch helps to reduce erosion and conserve moisture. Overgrazing the rangeland reduces the vegetative cover and causes deterioration of the plant community; the taller, more desirable grasses are replaced by less productive short grasses. Livestock tend to undergraze the grass in the rough, steep areas of these soils and to overgraze the grass in the smoother areas. Although overgrazing the steep areas would cause very severe erosion, these areas generally could be more intensively grazed. This is especially true for the areas farthest from the drinking water. Cross fencing, salting, or impounding livestock water will force the livestock into these steep areas, thus helping to distribute grazing and improving overall productivity. In addition, proper stocking, deferred grazing, and a planned grazing system help to keep the rangeland and the soil in good condition.

Windbreaks generally are difficult to establish on these soils because of droughtiness. In addition, the shallowness of the soils prevents the use of machinery in planting trees and in cultivating. Where the Duda soil is extensive in this unit, a few trees and shrubs can be planted if care is taken to protect the seedlings. Only trees and shrubs that can tolerate the sandy, somewhat droughty condition of these soils should be planted. Droughtiness and the hazard of soil blowing are the main hazards to seedling establishment. Soil blowing can be controlled by maintaining a strip of sod or other vegetation between the rows of trees.

These soils are moderately limited for use as sites for houses because of the steep slopes and shallowness over sandstone. The steep slopes and shallowness over bedrock also are limitations to septic tank absorption fields and sewage lagoons. Sewage lagoons generally can be constructed on some of the deeper, less sloping soils on foot slopes or on the broader ridgetops. The steepness of slopes is a severe limitation to local roads.

The capability unit is VIs-4; the Tassel soil is in the Shallow Limy range site and in windbreak suitability group 10; the Duda soil is in the Sandy range site and in windbreak suitability group 7.

TrG—Tassel-Ronson-Duda complex, 15 to 70 percent slopes. This map unit consists of shallow and moderately deep, steep and very steep, well drained soils on bluffs and breaks of side slopes along streams and drainageways that extend into the uplands. In most areas, the landscape is dissected by deep drainageways. The areas of this unit range from 20 to several hundred acres.

The unit is 25 to 40 percent Tassel soil, 20 to 30 percent Ronson soil, and 15 to 30 percent Duda soil. The Tassel soil is near the upper part of slope breaks and on the steeper and more convex slopes. The Duda and Ronson soils are on the smoother, more concave slopes and on the lower part of slopes. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Tassel soil is dark grayish brown, very friable loamy fine sand about 4 inches thick. The next layer is light gray, very friable fine sand about 8 inches thick. The underlying material consists of light gray sand and fragments of sandstone. Consolidated sandstone is at a depth of about 18 inches. In some areas, the surface layer is fine sandy loam or fine sand. In other areas, sandstone is exposed at the surface.

Typically, the surface layer of the Ronson soil is dark grayish brown, very friable fine sandy loam about 4 inches thick. The subsurface layer is grayish brown, very friable fine sandy loam about 5 inches thick. The next layer is light gray, very friable fine sandy loam about 14 inches thick. The underlying material is very pale brown fine sandy loam. White consolidated sandstone is at a depth of about 35 inches.

Typically, the surface layer of the Duda soil is grayish brown, very friable sandy loam about 6 inches thick. The next layer is brown, very friable sandy loam about 8 inches thick. The underlying material is pale brown fine sand. Weakly cemented sandstone is at a depth of about 36 inches. The sandstone generally is calcareous, but the sand in the cracks is noncalcareous. In some areas, the surface layer is loamy fine sand or fine sand. In some places, the sandstone is below a depth of 40 inches.

Included in mapping and making up 20 to 35 percent of this map unit are small areas of Anselmo, Inavale, Keota, Mariaville, and Valentine soils. Anselmo, Inavale, and Valentine soils are deep. Keota soils are moderately deep over siltstone and Mariaville soils are shallow over siltstone. Anselmo soils are on smooth, concave ridges. Inavale soils are along drainageways. Keota soils are on the lower part of toe slopes. Mariaville soils are along sharp slope breaks just above the deeper drainageways. Valentine soils are in areas where sand has been blown onto the upper part of slopes.

Permeability is rapid in the Tassel soil and moderately rapid in the Ronson and Duda soils. The available water capacity of these soils is low. Runoff is slow to rapid. The root zone is restricted by the sandstone; however, tree roots can penetrate cracks in the sandstone.

These soils are in native vegetation of grass and trees. The trees are mainly pines. On some slopes, the stand of trees is thick enough to shade out the grass. There are broad-leaved trees along most drainageways. These soils have very poor potential for cultivated crops. They have fair to poor potential for use as rangeland, for the production of native pines as wood crops, and for the development of habitat for wildlife. These soils have very poor potential for building site development and sanitary facilities and poor potential for recreation use.

These soils are best suited to use as rangeland. Because of the low available water capacity and rapid

runoff, these soils are droughty. Water erosion is a hazard if the vegetation is destroyed or has deteriorated. Livestock tend to undergraze the grass in the steep areas and to overgraze the grass in the smoother areas. The number of livestock should be adjusted according to seasonal conditions, and grazing should be deferred in some periods to prevent overgrazing.

Erosion is a severe hazard on these soils. The use of equipment in managing and harvesting woodland is moderately restricted, and seedling mortality is a moderate limitation. Tree windthrow and plant competition are slight hazards.

These soils are severely limited for use as sites for houses mainly because of the very steep slopes and the shallowness over sandstone. The very steep slopes and shallowness over bedrock also are limitations to septic tank absorption fields and sewage lagoons. Sewage lagoons generally can be constructed on some of the deeper, less sloping soils on foot slopes or on the broader ridgetops. The very steep slopes are a severe limitation to local roads.

The capability unit is VIIs-4, dryland; the Tassel soil is in the Shallow Limy range site, and the Ronson and Duda soils are in the Savannah range site; these soils are in windbreak suitability group 10.

Tu—Tuthill fine sandy loam, 0 to 2 percent slopes. This is a deep, nearly level, well drained soil on uplands and toe slopes. The areas generally are slightly elongated and range from 4 to 160 acres.

Typically, the surface soil is dark grayish brown, very friable fine sandy loam about 11 inches thick. The subsoil is friable and extends to a depth of about 27 inches. It is grayish brown fine sandy loam in the upper part, light brownish gray sandy clay loam in the middle part, and pale brown fine sandy loam in the lower part. The underlying material is light gray, calcareous loamy fine sand. Sandstone is at a depth of about 48 inches. In some areas the surface soil is light loam, and in a few areas it is loamy fine sand. In many places, the sandstone is at a depth of more than 60 inches.

Included in mapping are small areas of Dunday, Holt, Manter, Paka, Vetal, and Wewela soils. Dunday soils have more sand than this Tuthill soil. Holt soils have sandstone within a depth of 40 inches. Manter soils have less clay in the subsoil than this Tuthill soil. Dunday, Holt, and Manter soils are slightly higher on the landscape than this Tuthill soil. Paka soils have more silt than this soil. Vetal soils are dark colored to a depth of more than 20 inches. Wewela soils are moderately deep over shale. Paka, Vetal, and Wewela soils are in lower positions on the landscape. The included soils make up 5 to 15 percent of this map unit.

Permeability is moderate. Runoff is slow. The available water capacity is moderate. The organic matter content is moderately low. Tilth is good, and the soil is easy to work within a wide range in moisture content.

About 50 percent of the acreage is native rangeland. The rest is mainly cultivated cropland. In a few small areas, this soil is used for windbreaks. This soil has good potential for cultivated crops, either dryfarmed or irrigated. It has fair potential for native or tame grasses and for the development of habitat for rangeland wildlife. This soil has good potential for trees and shrubs in windbreaks, for recreation uses, and for use as septic tank absorption fields. It has fair potential for building site development and poor potential for sewage lagoons.

This soil is well suited to dryfarmed corn, sorghum, small grains, and alfalfa. However, insufficient rainfall is a limitation if this soil is used as dryfarmed cropland. Soil blowing is a hazard. Following row crops with a close-growing crop and leaving most of the crop residue on the surface help to improve the organic matter content and to control soil blowing.

If this soil is irrigated, it is best suited to corn and alfalfa. A gravity irrigation system that makes use of contour furrows or borders can be used on the lower part of slopes. A sprinkler system is needed on the higher, more irregular slopes. Commercial fertilizer or barnyard manure needs to be applied to maintain or improve fertility. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

Using this soil as pasture or rangeland is effective in controlling soil blowing and water erosion. Overgrazing the rangeland reduces the vegetative cover and causes deterioration of the plant community. Proper range use and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil is well suited to field windbreaks, farmstead and feedlot windbreaks, range or livestock windbreaks, and recreation or wildlife plantings. Only trees and shrubs that can tolerate the slightly sandy, somewhat droughty condition of this soil are suitable. Droughtiness and the severe hazard of soil blowing are the main limitations to establishing trees. Soil blowing needs to be controlled by maintaining a strip of sod or other vegetation between the rows of trees.

This soil is moderately limited for use as sites for houses because of the moderate shrink-swell potential. Replacing the abutting soil material with material that has more sand helps to reduce damage caused by shrinking and swelling. This soil is severely limited for sewage lagoons because of seepage. The bottom of the lagoon needs to be sealed with slowly permeable soil material to control seepage. The low strength of this soil is a moderate limitation to use as a site for local roads and streets; the base material needs to be replaced or strengthened to overcome this limitation.

The capability unit is IIe-3, dryland, and IIe-5, irrigated; this soil is in the Sandy range site; it is in windbreak suitability group 3.

VaF—Valentine fine sand, rolling. This is a deep, excessively drained soil on rolling uplands. The slopes are complex and range from 6 to 17 percent. The areas range from 20 to 1,000 acres.

Typically, the surface layer is dark grayish brown, very friable fine sand about 7 inches thick. The next layer is

grayish brown, loose fine sand about 8 inches thick. The underlying material, to a depth of 60 inches, is pale brown fine sand. In a few areas, the surface layer is less than 2 inches thick, and the slopes are very steep. In places, the dark surface layer is loamy fine sand; in other places, it is more than 10 inches thick.

Included in mapping are small areas of Simeon soils and blowout areas. Simeon soils have more gravel and coarse sand; they are nearly level to gently sloping and are between the sand dunes and the upper part of steep slope breaks along drainageways. The included areas make up 5 to 10 percent of the map unit.

Permeability is rapid. Runoff is slow or medium. The available water capacity is low. The organic matter content is low. This soil absorbs moisture rapidly and releases it readily to plants.

This soil is used mainly as native rangeland. In a few small areas, it is cultivated; this cropland is generally in areas where this soil is in association with less sloping soils. This soil has very poor potential for cultivated crops. It has fair potential for use as rangeland or tame pasture, for recreation uses, for trees in windbreaks, and for the development of habitat for rangeland wildlife. This soil has good potential for building site development, fair potential for septic tank absorption fields, and poor potential for sewage lagoons.

This soil is not suitable for cultivated crops. Where this soil is now cultivated, rangeland can be established by planting warm-season native grasses. To establish the rangeland grasses, seedbed preparation, a cover crop, adapted seeds, and weed control are needed.

This soil is suited to use as rangeland. Using this soil as rangeland is effective in controlling soil blowing and water erosion. However, overgrazing the rangeland or using improper haying methods reduces the vegetative cover, causes deterioration of the plant community, increases soil blowing, and creates small blowouts. Proper range use, deferred grazing or haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil (fig. 13).

This soil generally is not suited to field windbreaks; however, it provides a fair site for farmstead or feedlot windbreaks and for range or livestock plantings. The soil is so loose that trees need to be planted in shallow furrows and left uncultivated. During high winds, seedlings can be damaged by sandblasting or covered with drifting sand.

This soil is moderately to severely limited for use as sites for houses, roads and streets, and septic tank absorption fields because of the steepness of slopes. Excavations or fill material will be needed to provide a suitable site for houses that do not have a basement. Houses that have a basement can be designed to complement the slope, or the slope can be modified by grading. If local roads and streets are constructed, cuts and fills or a design that complements the slope may be needed. If this soil is used as a septic tank absorption field, drain trenches should be installed on the contour to insure that effluent is dispersed throughout the absorption area. This soil is severely limited for sewage lagoons because of seepage. The sandiness of the soil and the hazard of soil blowing are moderate limitations to camp areas and picnic areas and severe limitations to playgrounds and paths and trails.

The capability unit is VIe-5, dryland; this soil is in the Sands range site; it is in windbreak suitability group 7.

VaG—Valentine fine sand, hilly. This is a deep, excessively drained soil on large, steep dunes and high, pointed hilltops. The slopes ranges from 17 to 60 percent. Some of the slopes have catsteps. The areas range from 20 to 200 acres.

Typically, the surface layer is dark grayish brown, loose fine sand about 4 inches thick. The layer below that is grayish brown, loose fine sand about 8 inches thick. The underlying material, to a depth of 60 inches, is pale brown fine sand.

Included in mapping are areas, as much as 40 acres in size, of the more gently sloping Valentine soils. Also included are small areas of blown-out land. Inclusions make up less than 20 percent of this map unit.

Permeability is rapid, and the available water capacity is low. Runoff is slow. The organic matter content is low. The soil is slightly acid to neutral.

This soil is used as rangeland. It has very poor potential for cultivated crops and is not suitable for irrigation. This soil has fair potential for the development of habitat for rangeland wildlife and for use as native rangeland. It has poor potential for building site development, recreation uses, and sanitary facilities. This soil has very poor potential for trees and shrubs in windbreaks.

This soil is too steep for cultivated crops or for use as hayland. If carefully managed, this soil produces a fair yield of native grass. It is highly susceptible to soil blowing if the grass cover is destroyed. Proper stocking and deferred grazing help to maintain or improve the stand of grass and to control erosion. The slopes are so steep that livestock have difficulty moving over the areas. Uniform grazing can be achieved by properly peacing fences, salt, and water.

This soil generally is not suited to windbreaks because the soil is loose and the slopes very steep. The use of machinery in planting trees is restricted to the less sloping soils included in the unit. During high winds, seedlings can be damaged by sandblasting or covered with drifting sand.

This soil is severely limited for use as sites for houses, roads and streets, and septic tank absorption fields because of the steepness of slopes. Excavations or fill material will be needed to provide a suitable site for houses that do not have a basement. Houses that have a basement can be designed to complement the slope, or the slope can be modified by grading. If local roads and streets are constructed, cuts and fills or a design that complements the slope may be needed. Septic tank

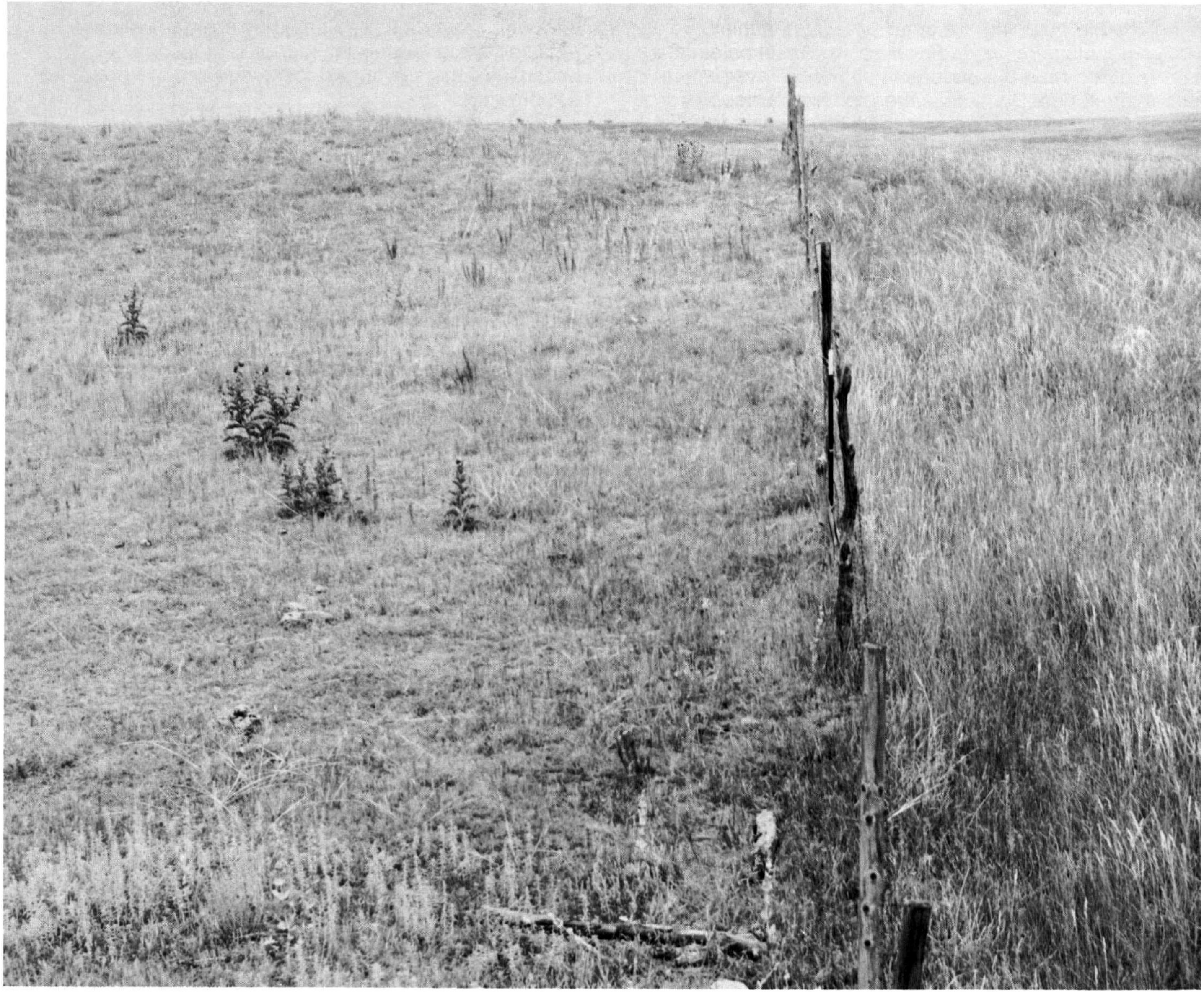


Figure 13.—An area of Valentine fine sand, rolling, in the Sands range site. Continued overgrazing has caused the range on the left to deteriorate. Unpalatable sage and thistles have invaded.

absorption fields should only be installed on the less sloping soils included in this map unit; drain trenches should be installed on the contour to insure that effluent is dispersed throughout the absorption area. This soil is severely limited for sewage lagoons because of seepage. It is severely limited for recreation uses because of the steepness of slopes and the sandiness of the soil.

The capability unit is VIIe-5, dryland; this soil is in the Choppy Sands range site; it is in windbreak suitability group 10.

VbD—Valentine loamy fine sand, gently rolling. This is a deep, excessively drained soil on uplands near the sandhills. The slopes range from 3 to 12 percent. The areas range from 5 to 500 acres.

Typically, the surface layer is dark grayish brown, very friable loamy fine sand about 5 inches thick. The layer below that is grayish brown, loose fine sand about 8 inches thick. The underlying material, to a depth of 42 inches, is light brownish gray fine sand; below that, it is white fine sand. In some areas, the dark surface layer is 10 to 20 inches thick. In places, there are mottles within a depth of 40 inches.

Included in mapping are small areas of Anselmo, Duda, Els, Elsmere, and Wewela soils. Anselmo soils are finer textured than this Valentine soil and are on smoother slopes. Duda soils are moderately deep over sandstone. Their position on the landscape is similar to that of the Valentine soil. Els and Elsmere soils are somewhat poorly drained and are in low swales. Wewela soils are in the lower areas and are moderately deep over weathered shale. The included soils make up 5 to 15 percent of the map unit.

Permeability is rapid. The available water capacity is low. Runoff is slow. The soil is slightly acid to neutral throughout.

In most areas, this soil is in native grass and is used for grazing. In some areas, it is cultivated and irrigated using a sprinkler system. This soil has fair potential for use as native rangeland. It has very poor potential for dryfarmed cultivated crops. This soil has poor potential for crops if a gravity system of irrigation is used. If a sprinkler irrigation system is used, this soil has fair potential for crops on slopes of less than 6 percent and poor potential on slopes of more than 6 percent. This soil has fair potential for trees and shrubs in windbreaks, for the development of habitat for rangeland wildlife, and for recreation uses. It has good to fair potential for building site development and for use as septic tank absorption fields and poor potential for sewage lagoons.

This soil is not suited to dryfarmed row crops. However, it can be used for close-growing crops such as alfalfa and grass. Soil blowing is a moderate to severe hazard. Low fertility and the somewhat droughty underlying material are moderate limitations to crops.

If this soil is irrigated, it is suited to alfalfa, pasture, close-growing crops, corn, and sorghum. A sprinkler system of irrigation, for example the center-pivot system, is the only irrigation system suitable on this soil. Maintaining a cover of crop residue on the surface, stripcropping, field windbreaks, minimum tillage, and applying fertilizer help to control soil blowing and maintain fertility.

This soil is suited to use as rangeland. Using this soil as rangeland is effective in controlling soil blowing and water erosion. However, overgrazing the rangeland or using improper haying methods reduces the vegetative cover, causes deterioration of the plant community, increases soil blowing, and creates small blowouts. Proper range use, deferred grazing or haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil generally provides fair sites for trees in windbreaks. The rate of survival and growth of adapted trees is fair. The soil is so loose that trees need to be planted in shallow furrows and left uncultivated. During high winds, seedlings can be damaged by sandblasting or covered with drifting sand.

This soil has good to fair suitability for use as sites for houses, septic tank absorption fields, and local roads and streets. Seepage is a limitation for sewage lagoons; the bottom needs to be sealed by special treatment. This soil is moderately limited for recreation uses because of the sandiness of the soil and the hazard of soil blowing.

The capability unit is VIe-5, dryland, and IVe-11, irrigated; this soil is in the Sands range site; it is in windbreak suitability group 7.

VcF—Valentine-Tassel complex, rolling. This map unit consists of deep and shallow, excessively drained to well drained soils on uplands. These soils are in areas where eolian sand has partly covered the shallow soil that formed over sandstone. The slopes range from 3 to 17 percent. The areas range from 20 to 600 acres.

This map unit is 40 to 75 percent Valentine soil and 20 to 25 percent Tassel soil. The Valentine soil is on rolling dunes and gently undulating slopes. The Tassel soil is on ridges and in swales. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Valentine soil is dark brown, loose fine sand about 3 inches thick. The layer below that is brown, loose fine sand about 6 inches thick. The underlying material, to a depth of 60 inches, is pale brown fine sand. In some areas, the dark surface layer is more than 20 inches thick.

Typically, the surface layer of the Tassel soil is light brownish gray, very friable fine sandy loam about 3 inches thick. The subsurface layer is grayish brown, very friable fine sandy loam about 5 inches thick. The layer below that is light gray, friable loam that has fragments of weathered sandstone; it is about 5 inches thick. Consolidated white sandstone is at a depth of 13 inches. In some areas, the surface layer is loamy fine sand. In places, the sandstone is at a depth of 20 to 36 inches.

Included in mapping are small areas of Anselmo and Holt soils. Anselmo soils are deep, loamy soils on the smoother slopes. Holt soils are on level ridgetops; they are moderately deep, loamy soils that have an accumulation of clay in the subsoil.

Permeability is rapid in the Valentine soil and moderately rapid in the Tassel soil. The available water capacity of these soils is low. The organic matter content is low. Runoff is slow to rapid depending on the soil texture and the slope. The root zone is restricted in the Tassel soil by sandstone.

These soils are mainly in native grass and are used for grazing. They have very poor potential for dryfarmed cultivated crops and are not suitable for irrigation. These soils have fair to poor potential for use as rangeland and for the development of habitat for rangeland wildlife. They have fair to very poor potential for trees in windbreaks. These soils have fair to poor potential for building site development, fair potential for recreation uses, and poor potential for sanitary facilities.

Because of the shallowness of the soils and the steepness of slopes, these soils are not suitable for cultivated crops.

These soils are best suited to use as rangeland. The rapid runoff on the Tassel soil can cause severe gully erosion on the surrounding steep sandy soils. Soil blowing is also a hazard. Maintaining an adequate cover of vegetation and ground mulch helps to reduce erosion. Overgrazing the rangeland reduces the vegetative cover and causes deterioration of the plant community. Proper range use, deferred grazing, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

Windbreaks generally are difficult to establish on these soils because of droughtiness. The use of machinery in planting trees and in cultivation is restricted on the shallow Tassel soil. Where the Valentine soil is extensive, a few trees and shrubs can be planted if care is taken to protect the seedlings. Only trees and shrubs that can tolerate the sandy, somewhat droughty condition of these soils should be planted. Droughtiness and the hazard of soil blowing are the main limitations to establishing trees on these soils. Soil blowing needs to be controlled by maintaining a strip of sod or other vegetation between the rows of trees.

Onsite investigation is needed to determine the suitability of these soils for building site development and septic tank absorption fields because of the variation in the kinds of soil. In areas where the shallow Tassel soil is extensive or where slopes are more than 8 percent, the soils have severe limitations for these uses. Seepage and the sandy soil material are limitations for sewage lagoons. If sewage lagoons are constructed, special treatment will be needed to control seepage, and the slopes may need to be modified. These soils are moderately to severely limited for roads and streets because of the shallowness or sandiness of the soils and the steepness of the slopes. If these soils are used as a site for local roads and streets, mulching and control structures will be needed to revegetate ditches and fills and to control erosion. Constructing the roads on the contour helps to reduce erosion.

The capability unit is VIe-5, dryland; the Valentine soil is in the Sands range site and in windbreak suitability group 7; the Tassel soil is in the Shallow Limy range site and in windbreak suitability group 10.

VdC—Valentine-Wewela loamy fine sands, 3 to 6 percent slopes. This map unit consists of deep and moderately deep, gently sloping and undulating, excessively drained and well drained soils on high stream terraces and uplands. The areas range from 10 to 200 acres.

This map unit is 45 to 55 percent Valentine loamy fine sand, clayey substratum; 25 to 30 percent Valentine loamy fine sand; and 20 to 25 percent Wewela soil. The Valentine soils are on long, high hummocks, and the Wewela soil is in swales and on low hummocks. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Valentine clayey substratum soil is dark grayish brown, very friable loamy fine sand about 5 inches thick. The layer below that is grayish brown, very friable fine sand about 9 inches thick. The underlying material is pale brown fine sand. Platy shale is at a depth of about 40 inches. The depth to shale ranges from 40 to 60 inches. In places, a thin layer of gravel overlies the shale.

Typically, the surface layer of the Valentine soil is dark grayish brown, very friable loamy fine sand about 5 inches thick. The layer below that is grayish brown, very friable fine sand about 9 inches thick. The underlying material is pale brown fine sand. In some areas, the surface layer is more than 10 inches thick.

Typically, the surface layer of the Wewela soil is dark grayish brown, very friable loamy fine sand about 6 inches thick. The subsurface layer is brown, very friable sandy loam about 4 inches thick. The subsoil is brown, friable clay loam about 11 inches thick. The underlying material is brown clay. Bedded shale is at a depth of about 26 inches. In some areas, the surface layer is fine sandy loam or sandy loam.

Included in mapping are small areas of Labu and Paka soils. These soils make up 15 percent or less of this map unit. Labu soils have a layer of clayey material over shale; they are on rounded ridges and in slightly raised positions. Paka soils are deep, loamy soils overlying siltstone; they are in slightly raised positions.

Permeability of Valentine loamy fine sand is rapid; it is rapid to moderate in the upper part of the Valentine clayey substratum soil and the Wewela soil and slow and very slow in the lower part. The available water capacity of these soils is low to moderate. Runoff is slow. The organic matter content is low to moderate. Water perched in the sandy layer overlying the shale is beneficial to plants.

In most areas, these soils are used as native rangeland. In a few small areas, they are used for alfalfa and as hayland. These soils have very poor potential for dryfarmed cultivated crops. They have fair potential for crops if a sprinkler system of irrigation is used and poor potential if a gravity system is used. These soils have fair potential for use as rangeland, for trees and shrubs in windbreaks, and for most recreation uses. They have good to fair potential for the development of habitat for rangeland wildlife. These soils have poor potential for building site development and for sanitary facilities.

These soils are only marginally suited to dryfarmed row crops. They are better suited to close-growing crops such as alfalfa, grasses, and small grains. If these soils are cultivated, soil blowing is a severe hazard. Leaving crop residue on the surface of the soil reduces soil blowing and maintains or improves the organic matter content. Narrow windbreaks also help to reduce soil blowing.

If these soils are irrigated, they are suited to alfalfa, pasture, close-growing crops, and corn. A sprinkler system of irrigation, for example, the center-pivot

system, is the only irrigation system suitable on these soils. Maintaining a cover of crop residue on the surface, stripcropping, field windbreaks, minimum tillage, and applying fertilizer help to control soil blowing and maintain fertility.

Using these soils as rangeland is effective in controlling soil blowing. However, overgrazing the rangeland or using improper haying methods reduces the vegetative cover, causes deterioration of the plant community, increases soil blowing, and creates small blowouts. Proper range use, deferred grazing or haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil. The small blowouts can be fenced to exclude livestock and then converted to rangeland by mulching and reseeding.

These soils generally are not suited to field windbreaks; however, they provide fair sites for farmstead or feedlot windbreaks and for range or livestock plantings. These soils are so loose that trees need to be planted in shallow furrows and left uncultivated. During high winds, seedlings can be damaged by sandblasting or covered with drifting sand.

These soils are poorly suited to use as septic tank absorption fields. The underlying shale or clay causes very slow vertical percolation and allows lateral seepage of septic fluids. Lateral seepage also is a limitation for sewage lagoons unless the sides of the lagoon are sealed. Onsite investigation is needed to determine the suitability of the Valentine soils for use as sites for houses. The Wewela soil is poorly suited to use as a site for houses that have a basement because the shale has high shrink-swell potential and the soil has low strength; if houses that have a basement are constructed on this soil, foundations and basement walls need to be designed to prevent damage caused by the low strength and shrinking and swelling of the soil. In addition, lateral seepage is a limitation to basements; this limitation can be overcome by replacing the abutting soil material and by providing drainage around the basement walls. Local roads and streets need to be designed to prevent damage caused by the low strength and shrinking and swelling of the soil; the base material may need to be replaced or modified.

The capability unit is VIe-5, dryland, and IVe-11, irrigated; the Valentine soil is in the Sands range site, and the Valentine clayey substratum and Wewela soils are in the Sandy range site; these soils are in windbreak suitability group 7.

VdF—Valentine-Wewela loamy fine sands, 6 to 30 percent slopes. This map unit consists of deep to moderately deep, strongly sloping to steep, excessively drained to well drained soils. These soils are on the side slopes of drainageways that are cutting into stream terraces or uplands. The areas of this map unit range from 10 to more than 200 acres.

This unit is 35 to 45 percent Valentine loamy fine sand, 25 to 35 percent Valentine loamy fine sand, clayey substratum, and 20 to 30 percent Wewela soil. The Valentine soil is on the middle part of slopes, where eolian sand was deposited over eroded shale. The Valentine clayey substratum soil is on the upper part of slopes and ridges. The Wewela soil is strongly sloping and is in areas where the shale is near the surface. These soils are so intermingled or the areas of each are so small that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Valentine soil is dark grayish brown, very friable loamy fine sand about 8 inches thick. The layer below that is grayish brown, loose fine sand about 12 inches thick. The underlying material is pale brown loamy sand. In some areas, the surface layer is fine sand. In others, it is more than 10 inches thick.

Typically, the surface layer of the Valentine clayey substratum soil is dark grayish brown, very friable loamy fine sand about 9 inches thick. The layer below that is grayish brown, very friable fine sand about 12 inches thick. The underlying material, to a depth of about 40 inches, is brown fine sand; below that, it is clay that weathered from shale. Shale is at a depth of 45 to 60 inches.

Typically, the surface layer of the Wewela soil is dark grayish brown, very friable loamy fine sand about 7 inches thick. The subsurface layer is grayish brown, very friable loamy fine sand about 11 inches thick. The subsoil is grayish brown, firm sandy clay loam about 5 inches thick. The underlying material, to a depth of about 40 inches, is light brownish gray weathered clay. Bedded shale is at a depth of about 40 inches. In places, the surface layer is fine sandy loam.

Included in mapping and making up about 15 percent of this unit are small areas of Anselmo and Labu soils. Anselmo soils are deep, loamy soils on ridges. Labu soils are moderately deep, clayey soils overlying shale; they generally are on the steeper slope breaks.

Permeability is rapid or moderate in the upper part of these soils and slow or very slow in the lower part. Runoff is medium to slow. The available water capacity is low to moderate. The organic matter content is low to moderately low.

The soils in this unit are used as rangeland. They are not suited to irrigation. These soils have very poor potential for dryfarmed cultivated crops and for trees and shrubs in windbreaks. They have fair potential for use as rangeland, for the development of habitat for rangeland and woodland wildlife, and for recreation uses. These soils have poor potential for building site development and sanitary facilities.

These soils are not suited to cultivated crops because of the coarse texture of the surface layer and the steepness of slopes.

In most areas, these soils are in native grassland and woodland. If the grass is overgrazed, soil blowing is a severe hazard. Proper stocking rates, deferred grazing, rotation grazing, and weed and brush control are needed to maintain the stands of native grass.

Windbreaks generally are not needed on these soils because of the abundant native bur oak. If windbreaks are needed, the trees have to be planted by hand on the steep slopes. Because of the sandy texture of the soils, only the native trees or conifers are suitable for planting.

These soils are severely limited as a site for houses and for sanitary facilities because of the steepness of slopes. If these soils are used for local roads and streets, special design is needed to overcome the low soil strength and to reduce damage caused by the shrinking and swelling of the soil. The material may need to be replaced or modified for this use.

The capability unit is VIe-5, dryland; the Valentine soil is in the Sands range site, and the Valentine clayey substratum and Wewela soils are in the Sandy range site; these soils are in windbreak suitability group 10.

Ve—Verdel silty clay loam, 0 to 1 percent slopes. This is a deep, level, well drained soil on stream terraces. It generally is on the terraces that are farthest from the stream channel and are adjacent to the surrounding hills. The areas range from 5 to 80 acres.

Typically, the surface soil is grayish brown, firm silty clay loam about 11 inches thick. The subsoil is about 27 inches thick. It is dark gray, firm silty clay in the upper part; olive gray, very firm silty clay in the middle part; and olive, very firm clay in the lower part. The underlying material is olive clay. In some areas, layers of loamy material are in the underlying material. In places, bedded shale is at a depth below 40 inches. In some areas, the surface soil is loam or silt loam.

Included in mapping are small areas of Cass and Munjor soils. These are loamy soils on small alluvial fans or in narrow drainageways. They make up 5 to 10 percent of this map unit.

The surface layer is friable; however, the soil puddles readily if it is worked or trampled when wet. Permeability is slow. Runoff is slow. The available water capacity is moderate. The shrink-swell potential is high. The organic matter content is moderate. The soil is mildly alkaline in the upper part and moderately alkaline in the lower part. Because of its fine texture, this soil releases water slowly to plants and is somewhat droughty.

This soil is used mainly for cultivated crops. In a few narrow areas near drainageways, it is used as native rangeland. This soil has good potential for use as dryfarmed or irrigated cropland. It has fair potential for native grasses. This soil has poor potential for trees and shrubs in windbreaks and for building site development. It has good potential for the development of habitat for openland wildlife and fair potential for rangeland wildlife. This soil has fair potential for recreation uses and poor to good potential for sanitary facilities.

This soil is suited to dryfarmed small grains, sorghum, corn, and alfalfa. It is best suited to small grains and alfalfa because these crops mature in spring or early in summer when droughtiness is not a concern. If this soil is used for crops, soil moisture needs to be conserved, the organic matter content improved, and tilth and fertility maintained. Minimum tillage and crop residue on the surface increase the amount of moisture absorbed by the soil and reduce evaporation. Soil blowing and water erosion are slight hazards.

If this soil is irrigated, it is suited to corn, sorghum, and alfalfa. It can also be used for small grains and grasses. The rate of water applications needs to be adjusted to correspond with the slow water intake rate of this soil. Land leveling to produce smooth, level fields and constructing diversions to divert runoff from the surrounding higher soils help to reduce pondings on this soil. A furrow or border irrigation system is suitable on this soil. A center-pivot sprinkler system generally is not suitable because transpiration and evaporation can exceed the required intake rate.

Using this soil as rangeland or for legumes is effective in maintaining fertility and tilth and in controlling erosion. Proper stocking, deferred and rotation grazing, and restricted use in wet periods help to keep pasture in good condition.

This soil is poorly suited to trees because of its high clay content, which creates a somewhat droughty condition for seedlings. Competition from grass and weeds for moisture is the main limitation. Site preparation and timely cultivation can increase seedling survival. Drought-tolerant trees and shrubs should be selected for planting.

This soil is severely limited for use as sites for houses and roads. The shrinking and swelling of the soil can damage roads and building foundations. In addition, this soil has inadequate strength to support loads. If this soil is used as a building site, foundations and footings need to be designed and artificial drainage provided to prevent structural damage. If this soil is used for roads, the site needs to graded and a suitable base material used. This soil is well suited to sewage lagoons. It is severely limited for use as septic tank absorption fields because of the slow permeability of the soil. This limitation can be overcome by increasing the size of the absorption area.

The capability unit is IIs-2, dryland, and IIs-1, irrigated; this soil is in the Clayey range site; it is in windbreak suitability group 9.

VeB—Verdel silty clay loam, 1 to 3 percent slopes. This is a deep, very gently sloping, well drained soil on terraces. It generally is on the terraces that are farthest from the stream channel and are adjacent to the surrounding hills. The areas range from 5 to 80 acres.

Typically, the surface soil is dark grayish brown, friable silty clay loam about 18 inches thick. The subsoil is dark grayish brown, firm silty clay about 18 inches thick. The underlying material, to a depth of 60 inches, is grayish brown clay.

Included in mapping are small areas of Cass and Munjor soils. These are loamy soils on small alluvial fans or in narrow drainageways. They make up 5 to 15 percent of this map unit.

The surface layer is friable; however, the soil puddles readily if it is worked or trampled when wet. Permeability is slow. Runoff is slow. The available water capacity is moderate. The shrink-swell potential is high. The organic matter content is moderate. The soil is mildly alkaline in the upper part and moderately alkaline in the lower part. Because of its fine texture, this soil releases water slowly to plants and is somewhat droughty.

This soil is used mainly for cultivated crops. In a few narrow areas near drainageways, it is used as native rangeland. This soil has good potential for use as dryfarmed or irrigated cropland. It has fair potential for native grasses. This soil has poor potential for trees and shrubs in windbreaks and for building site development. It has good potential for the development of habitat for openland wildlife and fair potential for rangeland wildlife. This soil has fair potential for recreation uses and good to poor potential for sanitary facilities.

This soil is suited to dryfarmed small grains, sorghum, corn, and alfalfa. It is best suited to small grains and alfalfa because these crops mature in spring or early in summer when droughtiness is not a concern. If this soil is used for crops, soil moisture needs to be conserved, the organic matter content improved, and tilth and fertility maintained. Minimum tillage and crop residue on the surface increase the amount of moisture absorbed by the soil and reduce evaporation. Soil blowing and water erosion are slight hazards.

If this soil is irrigated, it is suited to corn, sorghum, and alfalfa. It can also be used for small grains and grasses. The rate of water application needs to be adjusted to correspond with the slow water intake rate of this soil. Land leveling to produce smooth, level fields and constructing diversions to divert runoff from the surrounding higher soils help to reduce ponding on this soil. A furrow or border irrigation system is suitable on this soil. A center-pivot sprinkler system generally is not suitable because transpiration and evaporation can exceed the required intake rate.

Using this soil as rangeland or for legumes is effective in maintaining fertility and tilth and in controlling erosion. Proper stocking, deferred and rotation grazing, and restricted use in wet periods help to keep pasture in good condition.

This soil is poorly suited to trees because of its high clay content, which creates a somewhat droughty condition for seedlings. Competition from grass and weeds for moisture is the main limitation. Site preparation and timely cultivation can increase seedling survival. Drought-tolerant trees and shrubs should be selected for planting.

This soil is severely limited for use as sites for houses and roads. The shrinking and swelling of the soil can damage roads and building foundations. In addition, this soil has inadequate strength to support loads. If this soil is used as a building site, foundations and footings need to be designed and artificial drainage provided to prevent structural damage. If this soil is used for roads, the site needs to be graded and a suitable base material used. This soil is well suited to sewage lagoons. It is severely limited for use as septic tank absorption fields because of the slow permeability of the soil. This limitation can be overcome by increasing the size of the absorption area.

The capability unit is IIe-4, dryland, and IIe-1, irrigated; this soil is in the Clayey range site; it is in windbreak suitability group 9.

VeC—Verdel silty clay loam, 3 to 6 percent slopes. This is a deep, gently sloping, well drained soil on high terraces and upland toe slopes. The areas range from 10 to 100 acres.

Typically, the surface layer is dark gray, friable silty clay loam about 6 inches thick. The subsurface layer is grayish brown, friable silty clay about 10 inches thick. The subsoil is grayish brown and light brownish gray, firm silty clay about 14 inches thick. The underlying material is light brownish gray clay. Bedded shale is at a depth of about 48 inches. In places, sandy material has been blown onto this soil and incorporated into the plow layer. In some areas, the shale is within a depth of 40 inches.

Included in mapping are small areas of Anselmo, Manter, Paka, and Wewela soils. Anselmo and Manter soils are deep and loamy. They are slightly higher on the landscape than the Verdel soil. Paka soils are deep and silty. The are lower on the landscape than the Verdel soil. Wewela soils are loamy and are moderately deep over shale. The included soils make up 10 to 25 percent of this map unit.

The surface layer of this soil is friable; however, the soil puddles readily if it is worked or trampled when wet. Runoff is slow. Permeability is slow, and the available water capacity is moderate. The organic matter content is moderate. The shrink-swell potential is high. This soil is mildly alkaline in the upper part and moderately alkaline in the lower part. Because of its fine texture, this soil releases water slowly to plants and is somewhat droughty.

This soil is used mainly for cultivated crops. In a few narrow areas near drainageways, it is used as native rangeland. This soil is not suited to irrigation. It has fair potential for dryfarmed cultivated crops. This soil has poor potential for trees and shrubs in windbreaks. It has fair potential for recreation uses and for the development of habitat for openland and rangeland wildlife. This soil has poor potential for building site development and fair to poor potential for sanitary facilities.

This soil has fair suitability for dryfarmed small grains, sorghum, corn, and alfalfa. It is best suited to small grains and alfalfa because these crops mature in spring or early in summer when droughtiness is not a concern. If this soil is used for crops, soil moisture needs to be conserved, the organic matter content improved, and tilth and fertility maintained. Minimum tillage and crop residue on the surface increase the amount of moisture absorbed by the soil and reduce evaporation. Soil blowing and water erosion are slight hazards.

This soil is not suited to irrigation because of the steepness of slopes and the very slow water intake rate. If this soil is irrigated, most of the irrigation water will be lost as runoff, which will increase erosion and sedimentation.

Using this soil for pasture grasses and legumes is effective in maintaining fertility and tilth and in controlling erosion. Proper stocking, deferred and rotation grazing, and restricted use in wet periods help to keep pasture in good condition.

This soil is poorly suited to trees because of its high clay content, which creates a somewhat droughty condition for seedlings. Competition from grasses and weeds for moisture is a major limitation. Site preparation and timely cultivation can increase seedling survival. Drought-tolerant trees and shrubs should be selected for planting.

This soil is severely limited for use as sites for houses and roads. The shrinking and swelling of the soil can damage roads and building foundations. In addition, this soil has inadequate strength to support loads. If this soil is used as building sites, foundations and footings need to be designed and artificial drainage provided to prevent structural damage. If this soil is used for roads, the site needs to be graded and a suitable base material used. This soil has moderate limitations for sewage lagoons because of the steepness of slopes. It is severely limited for use as septic tank absorption fields because of the slow permeability. This limitation can be overcome by increasing the size of the absorption area.

The capability unit is IIIe-4, dryland; this soil is in the Clayey range site; it is in windbreak suitability group 9.

Vo—Vetal fine sandy loam, 0 to 2 percent slopes. This is a deep, nearly level, well drained soil on smooth uplands and high stream terraces. The areas are slightly elongated and range from 10 to 200 acres.

Typically, the surface layer is very friable, grayish brown fine sandy loam about 6 inches thick. The subsurface layer is friable, dark gray fine sandy loam about 8 inches thick. The next layer, which extends to a depth of about 50 inches, is dark grayish brown and grayish brown, very friable fine sandy loam. The underlying material is brown loamy fine sand. In a few areas, soil blowing has removed some of the finer particles from the surface layer. Where this soil is in small depressions, the surface layer is loam. In a few areas, siltstone or sandstone is at a depth below 40 inches.

Included in mapping are small areas of Dunday, Holt, and O'Neill soils in slightly raised positions. Dunday soils are sandy throughout. Holt soils have sandstone at a depth of 20 to 40 inches. O'Neill soils have sand or gravel at a depth of 20 to 40 inches. These included soils make up less than 15 percent of this map unit.

Permeability is moderately rapid. Runoff is slow. The available water capacity is high. The organic matter content is moderately low. Tilth is good, and the soil can be tilled easily within a wide range in moisture content.

About 85 percent of the acreage is used for cultivated crops. The rest is mainly rangeland. This soil has good potential for the commonly grown cultivated crops, either dryfarmed or irrigated. It has fair potential for native or tame grasses. This soil has good potential for trees and shrubs in windbreaks, for the development of habitat for rangeland or openland wildlife, for recreation uses, for building site development, and for use as septic tank absorption fields. It has poor potential for sewage lagoons.

This soil is well suited to dryfarmed corn, small grains, sorghum, alfalfa, and tame grasses. Soil blowing and water erosion are moderate hazards. Including legumes or grasses or both in the cropping system helps to maintain the organic matter content and fertility and to control soil blowing. Leaving crop residue on the surface also helps to improve fertility and control soil blowing.

If this soil is irrigated, it is suited to most of the crops commonly grown in the county. The main crops are corn and alfalfa. Some land leveling will generally be needed if a gravity irrigation system is used. Because of the coarse to moderately coarse textured subsoil and underlying material of this soil, the irrigation runs need to be shorter than those on deep, silty soils. A sprinkler system of irrigation also is suitable on this soil. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

Using this soil as rangeland is effective in controlling erosion. Overgrazing the rangeland or using improper haying methods reduces the vegetative cover and causes deterioration of the plant community. Proper range use and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil provides good sites for field windbreaks, farmstead and feedlot windbreaks, range or livestock windbreaks, and recreation or wildlife plantings. Trees and shrubs that can tolerate the slightly sandy, somewhat droughty condition of this soil should be selected. Inadequate moisture and the hazard of soil blowing are the main limitations to establishing trees. Soil blowing can be prevented by maintaining a strip of sod or other vegetation between the rows of trees. Cultivation generally should be restricted to the tree rows. Chemical herbicides can be used to eliminate weeds, thus conserving moisture for the trees.

This soil has slight limitations to use as sites for houses. It has fair to good bearing strength if the soil is well compacted and confined. This soil also has slight limitations to use as septic tank absorption fields. It is not suited to sewage lagoons because of the excessive seepage; seepage can be prevented by sealing or lining the bottom and sides of the lagoon with impervious material. Frost action and low soil strength are moderate limitations to the construction of roads and streets on this soil. The soil can be mixed and treated with additives to overcome these limitations.

The capability unit is IIe-3, dryland, and IIe-8, irrigated; this soil is in the Sandy range site; it is in windbreak suitability group 3.

Vt—Vetal loam, 0 to 1 percent slopes. This is a deep, nearly level, well drained soil on smooth uplands and high stream terraces. The areas are slightly elongated and range from 10 to 100 acres.

Typically, the surface soil is friable, dark grayish brown loam about 18 inches thick. The subsoil extends to a depth of about 47 inches; it is dark grayish brown loam in the upper part, dark brown loam in the middle part, and brown loam in the lower part. The underlying material, to a depth of 54 inches, is pale brown loam; below that, it is very pale brown loamy fine sand. In a few areas, the surface soil is fine sandy loam. In places, siltstone or sandstone is at a depth below 40 inches.

Included in mapping are small areas of Holt soils in slightly raised positions. These soils are more droughty than this Vetal soil, and they have sandstone at a depth of less than 40 inches. Holt soils make up less than 10 percent of this unit.

Permeability is moderately rapid. Runoff is slow. The available water capacity is high. The organic matter content is moderate. Tilth is good, and the soil is easy to work within a fairly wide range in moisture content.

This soil is used mainly for cultivated crops. It has good potential for the commonly grown cultivated crops, either dryfarmed or irrigated. This soil has fair potential for native or tame grasses. It has good potential for trees and shrubs in windbreaks, for recreation uses, for the development of habitat for rangeland or openland wildlife, for building site development, and for use as septic tank absorption fields. This soil has poor potential for sewage lagoons.

This soil is well suited to dryfarmed corn, small grains, sorghum, alfalfa, and tame grasses. Soil blowing is a moderate hazard. Including legumes or grasses or both in the cropping system helps to maintain the organic matter content and fertility and to control soil blowing. Leaving crop residue on the surface also helps to improve fertility and control soil blowing.

If this soil is irrigated, it is suited to most of the crops commonly grown in the county. The main crops are corn and alfalfa. Some land leveling will generally be necessary if a gravity irrigation system is used. Because of the coarse to moderately coarse textured subsoil and underlying material, irrigation runs need to be shorter than those on deep, silty soils. A sprinkler system of irrigation also is suitable on this soil. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

Using this soil as rangeland is effective in controlling erosion. Overgrazing the rangeland or using improper haying methods reduces the vegetative cover and causes deterioration of the plant community. Proper range use and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil provides good sites for field windbreaks, farmstead and feedlot windbreaks, range or livestock windbreaks, and recreation or wildlife plantings. Trees and shrubs that are moderately tolerant of droughtiness should be used. Inadequate moisture and the hazard of soil blowing are the main limitations to establishing trees. Soil blowing can be prevented by maintaining a strip of sod or other vegetation between the rows of trees. Cultivation generally should be restricted to the tree rows. Chemical herbicides can be used to eliminate weeds, thus conserving moisture for the trees.

This soil has slight limitations to use as sites for houses. It has fair to good bearing strength if the soil is well compacted and confined. This soil also has slight limitations to use as septic tank absorption fields. It is not suited to sewage lagoons because of the excessive seepage; seepage can be prevented by sealing or lining the bottom and sides of the lagoons with impervious material. Frost action and low soil strength are moderate limitations to the construction of roads and streets on this soil. The soil can be mixed and treated with additives to overcome these limitations.

The capability unit is IIc-1, dryland, and I-6, irrigated; this soil is in the Silty range site; it is in windbreak suitability group 4.

VtB—Vetal loam, 1 to 3 percent slopes. This is a deep, very gently sloping, well drained soil on high stream terraces and uplands. The areas range from 10 to more than 200 acres.

Typically, the surface layer is firm, dark grayish brown loam about 10 inches thick. The subsoil is about 24 inches thick. It is grayish brown loam in the upper part and dark grayish brown, friable silt loam in the lower part. The underlying material, to a depth of 44 inches, is very pale brown, calcareous silt loam; below that, it is very pale brown fine sandy loam. In some areas, the plow layer is silt loam or fine sandy loam. In places, sand or sandstone is at a depth below 40 inches.

Included in mapping are small areas of Anselmo, Holt, Jansen, and Manter soils. All these soils have a thinner surface layer than the Vetal soil. Anselmo and Manter soils are deep and loamy. Holt soils are moderately deep over sandstone. Anselmo, Holt, and Manter soils are in hummocky areas. Jansen soils are moderately deep over sand or gravelly sand and are adjacent to deeply entrenched drainageways. The included soils make up 5 to 15 percent of this map unit.

Permeability is moderately rapid. Runoff is slow. The available water capacity is high. The organic matter content is moderate. Tilth is good, and the soil is easy to work within a fairly wide range in moisture content.

This soil is used mainly for cultivated crops. It has good potential for the commonly grown cultivated crops, either dryfarmed or irrigated. This soil has fair potential for native or tame grasses. It has good potential for trees and shrubs in windbreaks, for recreation uses, for the development of habitat for rangeland or openland

wildlife, for building site development, and for use as septic tank absorption fields. This soil has poor potential for sewage lagoons.

This soil is well suited to dryfarmed corn, small grains, sorghum, alfalfa, and tame grasses. Soil blowing and water erosion are moderate hazards. Including legumes or grasses or both in the cropping system helps to maintain the organic matter content and fertility and to control soil blowing. Leaving crop residue on the surface also helps to improve fertility and control soil blowing.

If this soil is irrigated, it is suited to most of the crops commonly grown in the county. The main crops are corn and alfalfa. Some land leveling will generally be necessary if a gravity irrigation system is used. A sprinkler system of irrigation also is suitable on this soil. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

Using this soil as rangeland is effective in controlling erosion. Overgrazing the rangeland or using improper haying methods reduces the vegetative cover and causes deterioration of the plant community. Proper range use and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil provides good sites for field windbreaks, farmstead and feedlot windbreaks, range or livestock windbreaks, and recreation or wildlife plantings. Trees and shrubs that are moderately tolerant of droughtiness should be used. Inadequate moisture and the hazard of soil blowing are main limitations to establishing trees. Soil blowing can be prevented by maintaining a strip of sod or other vegetation between the rows of trees. Cultivation generally should be restricted to the tree rows. Chemical herbicides can be used to eliminate weeds, thus conserving moisture for the trees.

This soil has slight limitations to use as sites for houses. It has fair to good bearing strength if the soil is well compacted and confined. This soil also has slight limitations to use as septic tank absorption fields. It is not suited to sewage lagoons because of the excessive seepage; seepage can be prevented by sealing or lining the bottom and sides of the lagoons with impervious material. Frost action and low soil strength are moderate limitations to the construction of roads and streets on this soil. The soil can be mixed and treated with additives to overcome these limitations.

The capability unit is IIe-1, dryland, and IIe-6, irrigated; this soil is in the Silty range site; it is in windbreak suitability group 4.

VtC—Vetal loam, 3 to 6 percent slopes. This is a deep, gently sloping, well drained soil on high stream terraces and toe slopes on uplands. The areas range from 5 to 50 acres.

Typically, the surface layer is very friable, grayish brown loam about 4 inches thick. The subsoil is about 27 inches thick. It is friable, dark grayish brown very fine sandy loam in the upper part and friable, dark grayish brown silt loam in the lower part. The next layer is friable, light brownish gray silt loam about 5 inches thick. The underlying material is light gray very fine sandy loam. In many areas the surface layer is silt loam, and in a few areas it is fine sandy loam. In places, sandstone or siltstone is at a depth below 40 inches.

Included in mapping are small areas of Anselmo, Holt, and Manter soils. These soils are dark colored to a lesser depth than the Vetal soil. Anselmo and Manter soils are deep and loamy. Holt soils are moderately deep over sandstone. The included soils are slightly higher on the landscape than the Vetal soil. They make up 5 to 10 percent of this map unit.

Permeability is moderately rapid. The available water capacity is high, and runoff is slow to medium. This soil absorbs water readily and releases it readily to plants. Tilth is good, and the soil is easy to till. The organic matter content is moderate. The soil is slightly acid to neutral.

This soil is used mainly for cultivated crops. In a few small irregularly shaped areas, it is used as native grassland. This soil has fair potential for use as dryfarmed or sprinkler-irrigated cropland. It also has fair potential for native grasses. This soil has good potential for trees and shrubs in windbreaks, for recreation uses, for the development of habitat for rangeland or openland wildlife, building site development, and for use as septic tank absorption fields. This soil has poor potential for sewage lagoons.

This soil can be used for dryfarmed corn, small grains, sorghum, alfalfa, and tame grasses. Soil blowing and water erosion are moderate hazards. If this soil is used for crops, moisture needs to be conserved and the organic matter content and high fertility maintained. Terraces and crop residue on the surface help to control erosion and conserve moisture. Alternating row crops with small grains or legumes and grasses helps to maintain the organic matter content and fertility and to control soil blowing.

Where this soil is irrigated, corn and alfalfa are the main crops. This soil is also suited to small grains, sorghum, and grasses. It is poorly suited to a gravity irrigation system because of slope and the hazard of erosion. A sprinkler irrigation system is suitable in areas where land leveling for gravity irrigation is not feasible. This soil requires frequent, light applications of water. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

Using this soil as rangeland is effective in controlling erosion. Overgrazing the rangeland or using improper haying methods reduces the vegetative cover and causes deterioration of the plant community. Proper range use and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil is suitable for field windbreaks, farmstead and feedlot windbreaks, range or livestock windbreaks, and recreation or wildlife plantings. Only trees and shrubs

that are moderately tolerant of droughtiness should be used. Inadequate moisture and the hazard of soil blowing are the main limitations to establishing trees. Soil blowing can be prevented by maintaining a strip of sod or other vegetation between the rows of trees. Cultivation generally should be restricted to the tree rows. Chemical herbicides can be used to eliminate weeds, thus conserving moisture for the trees. Water erosion is a hazard on the more sloping soils.

This soil is well suited to use as sites for houses. It has fair to good bearing strength if the soil is well compacted and confined. This soil can be used as septic tank absorption fields; however, pollution of ground water is a hazard in some areas. This soil is severely limited for sewage lagoons because of seepage; seepage can be prevented by sealing or lining the bottom and sides of the lagoons with impervious material. Frost action and low soil strength are moderate limitations to the construction of roads and streets on this soil. The soil can be mixed and treated with additives to overcome these limitations.

The capability unit is IIIe-1, dryland, and IIIe-6, irrigated; this soil is in the Silty range site; it is in windbreak suitability group 4.

WeB—Wewela fine sandy loam, 0 to 3 percent slopes. This is a nearly level and gently undulating, well drained soil on high stream terraces and uplands. This soil formed in areas where clayey shale is overlain by loamy material. The areas range from 5 to 80 acres.

Typically, the surface layer is gray, very friable fine sandy loam about 8 inches thick. The subsoil is grayish brown, firm sandy clay loam about 8 inches thick. The underlying material is light brownish gray and light olive brown clay. Bedded shale is at a depth of about 36 inches. The subsoil and underlying material generally are calcareous. In some areas, the surface layer is loam or loamy fine sand.

Included in mapping are small areas of Anselmo, Manter, and Paka soils. Anselmo and Manter soils are deep, loamy soils overlying sandy material. Paka soils are deep, silty soils overlying siltstone. Also included are small areas where the soil is eroded and the plow layer extends into the shale. The included soils are in the same landscape positions as the Wewela soil; they make up 5 to 15 percent of this map unit.

Permeability is moderate in the surface layer and subsoil and very slow in the underlying material. The available water capacity is moderate. Runoff is slow on the nearly level slopes and medium on the gently undulating slopes. The shrink-swell potential is low in the surface layer, moderate in the subsoil, and high in the underlying material. The organic matter content is moderately low. This soil is easy to till. It absorbs water readily, but, because of the silty and clayey subsoil and the clayey shale underlying material, it releases water slowly to plants. After a heavy rain, the depressions commonly are ponded.

In most areas, this soil is used for cultivated crops. In some areas, it is used for grass. This soil has fair potential for use as dryfarmed or gravity-irrigated cropland. It has good potential for crops if a sprinkler irrigation system is used. This soil has fair potential for use as native rangeland and for recreation uses. It has good potential for trees and shrubs in windbreaks and for the development of habitat for rangeland or openland wildlife. This soil has poor potential for building site development and sanitary facilities.

This soil has fair suitability for dryfarmed corn, sorghum, alfalfa, and tame grasses. It generally is best suited to alfalfa and tame grasses because these crops grow and mature in spring when rainfall is more plentiful. If this soil is cultivated, soil blowing and water erosion are hazards. In areas where shale outcrops at the surface, cultivation is difficult. Contour farming and stripcropping help to control soil blowing and water erosion. Tillage needs to be kept to a minimum. Including legumes or grasses or both in the cropping system helps to maintain the organic matter content and fertility and to control soil blowing. Leaving crop residue on the surface also helps to maintain or improve the organic matter content and to control soil blowing.

If this soil is irrigated, it is suited to corn, sorghum, small grains, and alfalfa. The main limitation is the slow water intake rate in the subsoil. Applications of irrigation water need to be light and frequent to prevent water from perching above the shale and saturating the loamy material. If a heavy rain occurs when the soil is saturated, water erosion in sloping areas can be severe, and low areas can be ponded. The same practices needed to control erosion in dryfarmed areas are needed on irrigated land.

Using this soil as rangeland is effective in controlling soil blowing and water erosion. Overgrazing the rangeland or using proper haying methods reduces the vegetative cover and causes deterioration of the plant community. Proper range use, deferred grazing or haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil is well suited to field windbreaks, farmstead and feedlot windbreaks, range or livestock windbreaks, and wildlife or recreation plantings. Trees and shrubs that are moderately tolerant of droughtiness are suitable. Competition from grass and weeds for moisture is the main limitation to establishing trees.

This soil is severely limited for building site development mainly because of the high shrink-swell potential and low strength of the subsoil. Foundations and footings need to be designed to prevent structural damage caused by shrinking and swelling or the abutting soil material can be replaced with readily available sandy material. If this soil is used as a site for roads, the base material needs to be replaced or modified. Shallow excavations should not be made when the soil is wet because of the high clay content. This soil is severely limited for sanitary facilities because of the moderate

depth to shale and the very slow permeability of the underlying material. This soil has slight limitations to most recreation uses. It is moderately limited for camp areas because of slow movement of effluent through the soil.

The capability unit is IIIe-3, dryland, and IIIe-9, irrigated; this soil is in the Sandy range site; it is in windbreak suitability group 4.

WeC—Wewela fine sandy loam, 3 to 6 percent slopes. This is a gently sloping and undulating, well drained soil on high stream terraces and uplands. This soil formed in areas where clayey shale is overlain by loamy material. The areas range from 5 to 100 acres.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 7 inches thick. The subsoil is about 13 inches thick. It is light olive brown, very friable loam in the upper part and light olive brown, friable clay in the lower part. The underlying material is light brownish gray clay. Bedded shale is at a depth of 32 inches. In some areas, the surface layer is sandy loam, loam, or loamy fine sand. In places, the original surface layer has been completely eroded.

Included in mapping are small areas of Labu, Paka, Valentine, and Verdel soils. Labu soils are moderately deep, clayey soils in higher lying positions. Paka soils are deep, silty soils; they are in landscape positions similar to those of this Wewela soil. Valentine soils are deep, sandy soils on hummocks. Verdel soils are deep, clayey soils in lower lying positions. The included soils make up 5 to 20 percent of this map unit.

Permeability is moderate in the upper part of the soil and very slow in the lower part. The available water capacity is moderate. Runoff is slow in the less sloping areas and medium in the more sloping areas. The shrink-swell potential is low in the surface layer, moderate in the subsoil, and high in the underlying material. The organic matter content is moderately low. This soil is easy to till. It absorbs water readily, but, because of the silty and clayey subsoil and the clayey shale underlying material, it releases water slowly to plants. After a heavy rain, the depressions commonly are ponded.

In most areas, this soil is in native grass and is used for hay or grazing. This soil has poor potential for use as dryfarmed cropland. It is suitable for irrigation. This soil has fair potential for use as native rangeland. It has good potential for trees and shrubs in windbreaks and for the development of habitat for openland and rangeland wildlife. This soil has fair potential for recreation uses and poor potential for building site development and sanitary facilities.

This soil is only marginally suited to row crops such as corn or sorghum because of droughtiness. It generally is best suited to tame grasses or alfalfa grown for hay because these crops grow and mature in spring when rainfall is more plentiful. If this soil is cultivated, soil blowing and water erosion are hazards. Gully erosion is a hazard in waterways. In areas where shale outcrops at the surface, cultivation is difficult. Terraces, contour farming, stripcropping, and grassed waterways help to control water erosion. Tillage needs to be kept to a minimum. Including legumes or grasses or both in the cropping system helps to maintain or improve the organic matter content and fertility and to control soil blowing. Leaving crop residue on the surface also helps to improve the organic matter content and to control soil blowing.

If this soil is irrigated, it is suited to corn, sorghum, small grains, and alfalfa. The main limitation is the slow water intake rate in the subsoil. Application of irrigation water needs to be light and frequent to prevent water from perching above the shale and saturating the loamy material. If a heavy rain occurs when the soil is saturated, water erosion in sloping areas can be severe. The same practices needed to control erosion in dryfarming areas are needed on irrigated land.

Using this soil as rangeland is effective in controlling soil blowing and water erosion. Overgrazing the rangeland or using improper haying methods reduces the vegetative cover and causes deterioration of the plant community. Proper range use, deferred grazing or haying, and a planned grazing system help to maintain or improve the condition of the rangeland and the soil.

This soil is suited to field windbreaks, farmstead and feedlot windbreaks, range or livestock windbreaks, and wildlife or recreation plantings. All trees and shrubs that are moderately tolerant of droughtiness are suitable. Competition from grass and weeds for moisture is the main limitation to establishing trees.

This soil is severely limited for building site development mainly because of the high shrink-swell potential and low strength of the subsoil. Foundations and footings need to be designed to prevent structural damage caused by shrinking and swelling, or the abutting soil material can be replaced with readily available sandy material. If this soil is used as a site for roads, the base material may need to be replaced or modified. Shallow excavations should not be made when the soil is wet because of the high clay content. This soil is severely limited for sanitary facilities because of the moderate depth to shale and very slow permeability. This soil has slight limitations to most recreation uses. It is moderately limited for camp areas because of the slow movement of effluent.

The capability unit is IVe-3, dryland, and IVe-9 irrigated; this soil is in the Sandy range site; it is in windbreak suitability group 4.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; for windbreaks; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

William E. Reinsch, conservation agronomist, Soil Conservation Service, helped to prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

According to the Conservation Needs Inventory of 1967, 12 percent of the agricultural land in Keya Paha County is cropland, and 80 percent is rangeland or pastureland. Alfalfa is grown to the largest extent, followed by corn. The acreage in small grains makes up less than 10 percent of the cropland.

The soils in Keya Paha County have good potential for increased food production. About 197,000 acres have potential for use as cropland. Of this acreage, 36,000 acres can be irrigated if an adequate water supply is available. If water is available and if erosion is controlled, an additional 75,000 acres can be irrigated.

dryland management

Soil blowing is a major hazard on the sandy soils in Keya Paha County. It is a hazard on 75 percent of the soils that have potential for use as cropland. If winds are strong and the soils are dry and bare of vegetation or surface mulch, soil blowing can damage these soils in a few hours. Maintaining vegetation or mulch on the surface or roughening the surface through proper tillage helps to minimize soil blowing. Windbreaks of adapted shrubs, trees, or grass are effective in reducing soil blowing on the sandy loam soils. Information on erosion-control practices for soils in various land uses is available at the local offices of the Soil Conservation Service.

Water erosion is a major hazard on about 25 percent of the potential cropland. Loss of surface layer material through water erosion damages the natural environment in two ways. First, soil productivity is reduced as the surface layer is eroded and subsoil material is incorporated into the plow layer. Second, erosion causes sedimentation in streams. Loss of surface layer material is especially damaging on soils that have a clay subsoil, for example Labu soil. Controlling erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal and recreation use and for fish and wildlife.

In general, using the more productive soils for row crops and using the steeper, light-textured, more erosive soils for close-growing crops such as wheat, rye, and alfalfa or for hay and pasture can reduce the hazard of

erosion in many areas of the county. In addition, erosion-control practices are needed that provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that maintains a vegetative cover on the soil can reduce erosion so that the productive capacity of the soil is not reduced.

On livestock farms, a cropping system that includes grasses and legumes as well as the use of manure to improve soil fertility can be used. This system reduces water erosion and soil blowing, provides plant nutrients, and improves tilth. Conservation tillage that leaves crop residue on the surface helps to reduce soil blowing and runoff. A minimum of 1,500 pounds of row-crop residue needs to be left on the soil after planting to significantly reduce erosion.

For row crop production, till-plant, no-till, and slot planting tillage systems are effective in reducing erosion on the sloping soils and can be adapted to most soils in the survey area. Terraces and diversions reduce the length of slopes and reduce runoff and erosion. They are most practical on deep, well drained soils that have regular slopes. Contour farming and contour stripcropping are best suited to soils that have smooth, uniform slopes. Manter and Paka soils are suitable for terraces and contour farming. Contour farming also improves the effectiveness of conservation tillage systems.

Under dryland management, the kind and the amount of fertilizer to apply should be based on the results of soil tests and on the moisture content of the soil at the time of application. When the subsoil is dry and rainfall is low, the rate at which fertilizer is applied should be slightly lower than when subsoil moisture is adequate. For nonlegume crops, nitrogen fertilizer is beneficial on all the soils. Phosphorus and zinc are needed on the more eroded soils and in areas cut for the construction of terraces or waterways.

Drainage and other soil features ar not major management concerns in Keya Paha County. Wetness is a soil limitation on less than 20,000 acres of the cropland.

Soil tilth is an important factor in the germination of seeds and the infiltration of the water into the soil. Soils that have good tilth are granular and porous. A cropping system that includes legumes and grasses in rotation, a conservation tillage system, and the use of crop residue help to improve soil tilth.

Irrigation management

Because of the limited ground water supply and the recent increase in irrigation development in Keya Paha County, additional sources of irrigation water may need to be developed. Where water is available, the predominant irrigation system in the county is sprinkler. Corn is the main irrigated crop. If the gently sloping soils, including Anselmo fine sandy loam, 2 to 6 percent slopes, are irrigated, they are subject to water erosion. They are subject to soil blowing unless at least 3,000 pounds of corn residue is left on the surface during winter.

The conservation practices that are used to control water erosion and soil blowing on dryland cropland also are effective on irrigated cropland. These include terraces, contour farming, crop residue use, and a conservation tillage system that maintains a cover of vegetation or crop residue on the surface after row crops are planted. These practices improve the rate of water intake, reduce runoff and erosion, and improve soil tilth.

A sprinkler irrigation system can be used on the sloping soils if conservation practices are used to control erosion. It is the most efficient on the sandy soils or in undulating areas, in keeping the top foot of soil moist. Sprinkler irrigation is the best system on soils that require frequent, light applications of water.

Surface irrigation can be used on the gently sloping soils. Land leveling can increase the efficiency of surface irrigation by allowing water to be distributed evenly. The efficiency of all irrigation systems can be improved by using a tailwater recovery system.

Contour bench leveling or contour furrow irrigation can be used on soils that have 2 to 6 percent slopes to help conserve rainfall and irrigation water. For maximum efficiency of an irrigation system, water should be applied to the soil when about one half of the water stored in the soil has been used by plants; for example, if a soil holds 8 inches of available water, irrigation water should be applied when about 4 inches of water is left in the soil and should replace only the amount of water that has been used by crops.

Irrigated soils generally produce higher yields than dryfarmed soils. Consequently, more plant nutrients, particularly nitrogen and phosphorus, are removed by crops. Returning all crop residue to the soil and adding barnyard manure and commercial fertilizer help to restore plant nutrients. Soils that are disturbed during land leveling, especially if surface soil has been removed, require and respond to fertilizer that includes phosphorus, zinc, and nitrogen. The kind and amount of fertilizer needed for specific crops can be determined by soil tests.

All the soil series in Nebraska are placed in irrigation design groups. These groups are described in the Nebraska Irrigation Guide, which is part of the Technical Guide. The arabic numeral in the irrigation capability units for each soil indicates the irrigation design group in which the soil has been placed. Assistance in planning and designing an irrigation system can be obtained at the local office of the Soil Conservation Service.

pasture and hayland management

Soils that are used for hay or as pasture should be managed for maximum production. A rotation grazing system that promotes uniform utilization of forage is required for optimum yields. A conservation cropping

system that includes grain crops and grasses and legumes in rotation helps to improve soil tilth, increases the organic matter content, and reduces erosion. Irrigated pasture requires a higher level of management for maximum forage production.

Pasture and hayland, under dryland or irrigation management, require additions of plant nutrients for maximum production. The kind and amount of fertilizer required should be determined by soil tests and by field trails.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-3 or IIIe-8.

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of each map unit is given in the section "Detailed soil map units."

rangeland

Peter N. Jensen, range conservationist, Soil Conservation Service, helped to prepare this section.

About 80 percent of the agricultural land in Keya Paha County is rangeland. The average size of ranches and livestock farms is 1,280 acres. Raising livestock, mainly cows and calves, is the largest agricultural enterprise in the county. Calves are sold in the fall as feeders. The rangeland generally is grazed from spring to fall. The cattle graze grain sorghum or corn residue in fall and early in winter, and they are fed hay or silage or both after that. The native forage commonly is supplemented with protein.

In some areas, the rangeland has been depleted by overuse. This overused rangeland supports grasses and broadleaf weeds that produce low amounts of forage. Proper range use, deferred grazing, and a planned grazing system help to improve rangeland productivity.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 7 shows, for many soils, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. Explanation of the column headings in table 7 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

About 50 percent of the rangeland in Keya Paha County is in the Sands, Sandy, and Choppy Sands range sites. About 25 percent is in the Shallow Limy, Shallow to Gravel, Shallow to Clay, and Savannah range sites. The rest of the rangeland is in Subirrigated, Wetland, Sandy Lowland, Clayey Overflow, Silty, and Clayey range sites. The range site for each soil in the survey area is given at the end of the soil descriptions and in table 7.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

woodland, windbreaks, and environmental plantings

James W. Carr, Jr., forester, Soil Conservation Service, helped to prepare this section.

The native woodland in Keya Paha County is limited to the steep canyons along the Niobrara River and its tributaries and to the narrow bottom lands of the Niobrara and Keya Paha Rivers and their tributaries. In many of these areas, the soils can produce commercial quantities of wood crops. The woodland also has esthetic value and can be used for recreation, wildlife habitat, and watershed protection.

Ponderosa pine is the dominant species in the Tassel-Ronson-Duda complex, 15 to 70 percent slopes, and

Mariaville-Keota silt loams, 15 to 60 percent slopes. Site quality varies within these map units; the best sites are in areas of the deeper soils and on northeast-facing slopes. Green ash, hackberry, bur oak, American elm, and American hophornbeam grow on the lower part of north- and east-facing slopes. The understory consists of smooth sumac, skunkbush sumac, western snowberry, small soapweed, American plum, and common chokecherry.

Eastern cottonwood, American elm, green ash, boxelder, willows, dogwood, and other water-tolerant trees and shrubs grow on the nearly level bottom lands.

The conifers, cedar and pine, are better suited to use in windbreaks than other species. Because they retain their leaves, conifers provide the most protection in winter. Several species of broad-leaved trees and shrubs, indicated in table 8, also are well suited to use in windbreaks in Keya Paha County.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

recreation

Robert O. Koerner, biologist, Soil Conservation Service, helped to prepare this section.

Recreation in Keya Paha County consists mainly of seasonal hunting and fishing. The Niobrara River is used for canoeing.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than

once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

wildlife habitat

Robert O. Koerner, biologist, Soil Conservation Service, helped to prepare this section.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and grain sorghum.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of introduced grasses and legumes are intermediate wheatgrass, smooth bromegrass, orchardgrass, sweetclover, red clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are big and little bluestem, indiangrass, switchgrass, forbs, wheatgrasses, blue grama, and sideoats grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are elm, oak, cottonwood, ash, hackberry willow, dogwood, and Russian-olive. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are autumn-olive, honeysuckle, cotoneaster, and skunkbush sumac.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of native coniferous plants are ponderosa and eastern red cedar. Examples of coniferous plants that are commercially available and suited to the soils in Keya Paha County are Austrian and Scotch pine.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are silver buffaloberry, plum, chokecherry, snowberry, coralberry, and skunkbush sumac.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, switch grasses, saltgrass, prairie cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are

created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, thrushes, woodpeckers, squirrels, red fox, raccoon, deer, and opossum.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, deer, sharptail grouse, meadowlark, and prairie chicken.

The wildlife habitat provided in the 14 soil associations in Keya Paha County are briefly described in the following paragraphs.

The Valentine-Tassel, Manter-Valentine, Tassel-Duda-Ronson, Wewela-Valentine-Anselmo, Anselmo-Labu, and Valentine soils associations provide habitat for rangeland wildlife, including white-tailed and mule deer, prairie grouse, coyote, meadowlark, lark buntings, and prairie dogs. Pheasants inhabit areas where the rangeland is near cropland and farmstead windbreaks.

The Ipage-Loup-Ord association provides habitat for wetland wildlife (fig. 14). There are marshy areas in this association and stream channels that have willows and brush. In many areas, the water table is near the surface. Alfalfa, which provides nesting cover for pheasants, is commonly grown. If feasible, the first cutting of alfalfa should be delayed until July 1 to 15 to allow time for pheasant nesting. In addition to upland game birds, beaver, mink, and muskrat inhabit areas of this association.

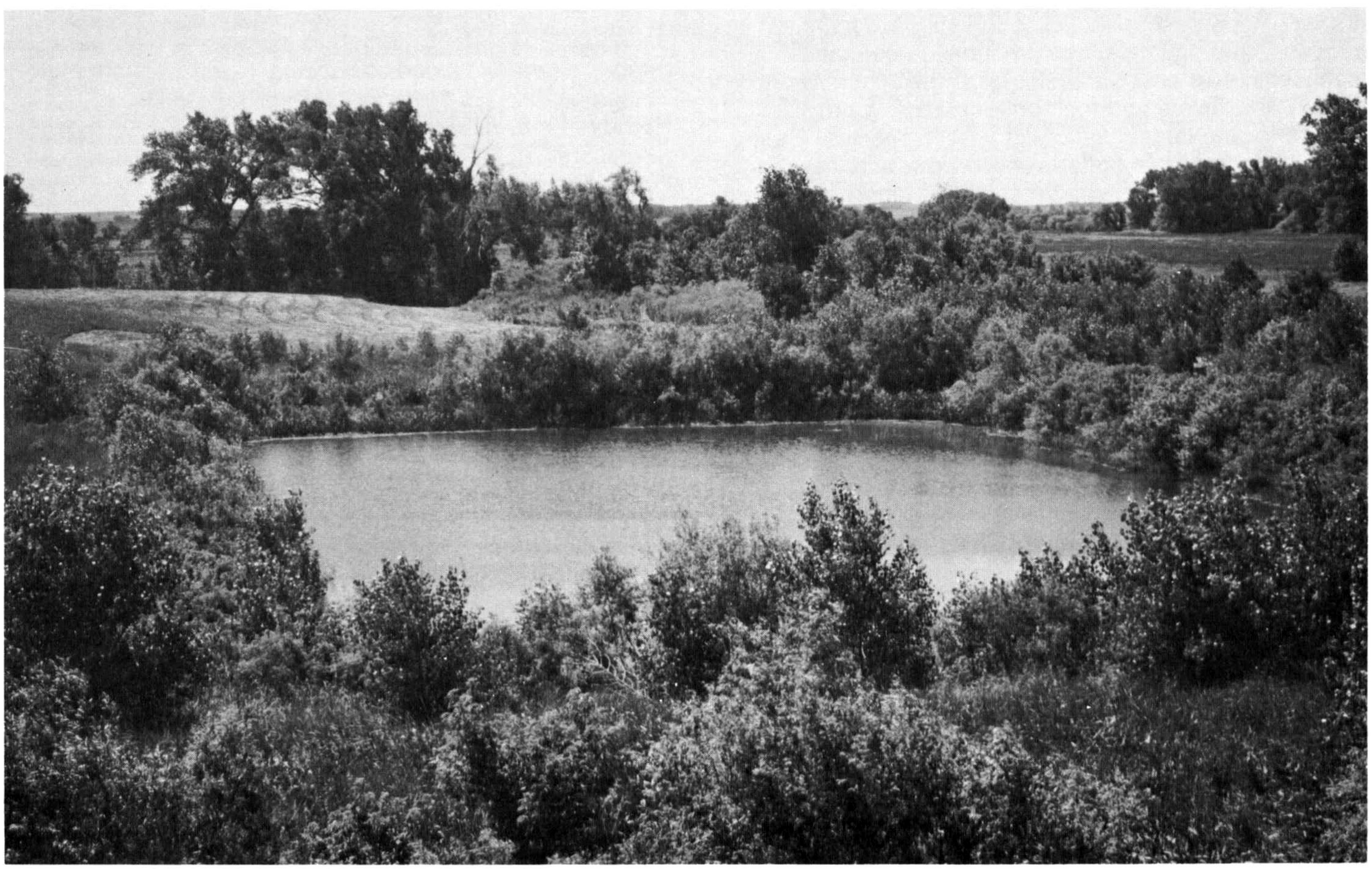


Figure 14.—A spring-fed fish pond in the Ipage-Loup-Ord association.

The Tassel-Mariaville-Ronson association provides habitat for woodland wildlife, including wild turkey, mourning dove, and tree squirrels. Drainageways provide travel lanes for the white-tailed and mule deer that range along the Niobrara River.

The Meadin-Jansen-O'Neill and the Jansen-Brocksburg-O'Neill associations provide habitat for openland wildlife, including pheasants and bobwhite quail. Deer from bottom lands use the cropland in this association for food. On cropland where a center-pivot irrigation system is used, the corners of the field, which are not irrigated, can provide food and cover for wildlife. The corners of these fields could be planted to trees, shrubs, or grasses to enhance the wildlife habitat.

The Labu-Sansarc association, which is in areas adjacent to the Niobrara and Keya Paha Rivers, provides habitat for rangeland wildlife. Trees such as native plum, chokeberry, and sumac grow in the drainageways. In some areas, alfalfa is grown on the lower part of slopes and provides nesting cover. Deer, turkey, and other wildlife travel across this association to the cropland of other soil associations.

The Inavale-Cass-Verdel association provides habitat for woodland wildlife, including turkey, opossum, raccoon, tree squirrels, deer, mourning dove, and songbirds. This association includes the Niobrara and Keya Paha Rivers and their bottom lands. It provides habitat for the largest variety of wildlife species. The native woodlands of cottonwood, willow, ash, hackberry, and boxelder provide escape cover for turkey and deer. Dead trees provide cover for squirrels, raccoons, and woodpeckers. The rivers provide water, and food is available on the nearby cropland.

The Vetal-Holt and the Reliance-Ree-Jansen associations provide habitat for openland wildlife, including pheasants and quail. Trees are scattered along the fencelines and have been planted in farmstead windbreaks. Pheasant and bobwhite quail require undisturbed nesting cover. If feasible, the first cutting of alfalfa should be delayed until July 1 to 15 to allow time for the nesting of these species.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many

local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 13 gives information about the soils as a source of construction materials. The soils are rated *good, fair, poor,* or *unsuited* as a source of roadfill, sand, gravel, and topsoil. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or

many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 11, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a good or fair source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 14 gives information on the soil properties and site features that affect water management. Soil limitations are given for pond reservoir areas and embankments, dikes, and levees. This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design

and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 18.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 18.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

physical and chemical properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility of soil to soil blowing and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

soil and water features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The bedrock in Keya Paha County is specified as rippable. It is soft or fractured and can be excavated with trenching machines, backhoes, or small rippers.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

engineering index test data

Table 18 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil series and morphology." The soil samples were tested by the State of Nebraska Department of Roads.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145-73; Unified classification—D 2487-69 (1975); Mechanical analysis—T 88-76I; Liquid limit—T 89-76I; and Plasticity index—T 90-70. The group index number that is a part of the AASHTO classification is computed using the Nebraska modified system.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*6*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 19, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning intermittently dry, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplustolls (*Hapl*, meaning minimal horizonation, plus *ustoll*, the suborder of Mollisols that have a ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-loamy, mixed, nonacid, mesic Typic Haplustolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*5*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*6*). Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Albaton Variant

The Albaton Variant consists of deep, poorly drained, nearly level soils on bottom lands. Albaton Variant soils formed in recent calcareous, clayey alluvium. Permeability is slow. The slopes are 0 to 2 percent.

Albaton Variant soils commonly are adjacent to Barney, Els, Inavale, Loup, and Ord soils. Barney, Loup, and Ord soils have more sand in the control section. Els and Inavale soils are sandy and have better drainage. Inavale soils are adjacent to the stream channel at a higher elevation than the Albaton Variant soils. Loup and Ord soils have a mollic epipedon, which Albaton Variant soils do not have. Ord soils have better drainage.

Typical pedon of Albaton Variant clay, 0 to 2 percent slopes, 1,300 feet north and 600 feet west of the southeast corner of sec. 32, T. 33 N., R. 17 W.

Ap—0 to 6 inches; olive gray (5Y 4/2) clay, very dark gray (10YR 3/1) moist; weak coarse platy structure parting to weak fine granular; hard, firm; many fine and medium roots; strong effervescence; moderately alkaline; abrupt smooth boundary.

A12—6 to 16 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; moderate coarse blocky structure parting to moderate medium subangular blocky; very hard, very firm; many fine and medium roots; slight effervescence; moderately alkaline; gradual smooth boundary.

Cg1—16 to 27 inches; stratified gray (5Y 5/1) and dark gray (5Y 4/1) clay, very dark grayish brown (10YR 3/2) moist; few medium distinct brownish yellow (10YR 6/6) mottles; weak coarse medium and fine subangular blocky structure; very hard, firm; common fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

Cg2—27 to 40 inches; gray (5Y 5/1) clay loam, dark gray (5Y 4/1) moist; few very thin strata of sandy material; few fine faint light yellowish brown (10YR 6/4) mottles; massive; very hard, firm; few fine roots; violent effervescence; moderately alkaline; abrupt wavy boundary.

IICg3—40 to 60 inches; light gray (5Y 6/1) sand, dark gray (5Y 4/1) moist; single grained; soft, loose; moderately alkaline.

The solum is 10 to 20 inches thick. Sand is at a depth of 40 to 60 inches.

The A horizon has value of 4 to 6, dry, and 3 to 4, moist, and chroma of 1 or 2. It is dominantly clay, but the range includes silty clay loam.

The C horizon has value of 5 to 6, dry, and 3 to 5, moist, and chroma of 0 to 2. It is dominantly clay in the upper part and is more sandy as depth increases. The C horizon is mainly sand below a depth of 40 inches.

Anselmo series

The Anselmo series consists of deep, well drained soils on uplands and stream terraces. Anselmo soils formed in mixed loamy and sandy eolian material. Permeability is moderately rapid. The slopes range from 0 to 30 percent.

Anselmo soils commonly are adjacent to Dunday, Holt, Manter, O'Neill, Ronson, Valentine, and Vetal soils. Dunday and Valentine soils have more sand than Anselmo soils. Valentine soils do not have a mollic epipedon. Unlike Anselmo soils, Holt and Manter soils have an argillic horizon and are generally calcareous in the C horizon; Holt soils are moderately deep over sandstone. O'Neill soils are moderately deep over sand and gravel. Ronson soils are moderately deep over sandstone and do not have a cambic horizon. Vetal soils have a mollic epipedon that is more than 20 inches thick.

Typical pedon of Anselmo fine sandy loam, 2 to 6 percent slopes, 300 feet south and 2,580 feet west of the northeast corner of sec. 25, T. 34 N., R. 21 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; common very fine roots; neutral; abrupt smooth boundary.

A12—6 to 16 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse medium and fine subangular blocky structure; slightly hard, very friable; common very fine roots; neutral; clear smooth boundary.

B2—16 to 22 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse and fine subangular blocky structure; slightly hard, very friable; few very fine roots; neutral; gradual smooth boundary.

C1—22 to 44 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; single grained; soft, very friable; neutral; clear smooth boundary.

C2—44 to 60 inches; light gray (10YR 7/2) loamy fine sand, pale brown (10YR 6/3) moist; single grained; loose; neutral.

The solum is 11 to 36 inches thick. The mollic epipedon is 7 to 20 inches thick. Free carbonates are at a depth of 30 to 60 inches.

The A horizon has value of 3 to 5, dry, and 2 to 3, moist, and chroma of 1 or 2. It typically is fine sandy loam, but the range includes loam and loamy fine sand.

The B2 horizon has value of 4 to 6, dry, and 3 to 4, moist, and chroma of 2 or 3. It is fine sandy loam or light loam.

The C horizon has value of 5 to 7, dry, and 4 or 5, moist, and chroma of 2 or 3. It typically is fine sandy loam or loamy fine sand and commonly is coarser as depth increases. In some pedons, a layer of silt loam or a buried soil is below a depth of 40 inches.

Barney series

The Barney series consists of deep, poorly drained soils on bottom lands. Barney soils formed in sandy alluvium. Permeability is rapid in the loamy surface layer and very rapid in the underlying sand. The slopes are 0 to 2 percent.

Barney soils commonly are adjacent to Albaton, Boel, Els, Inavale, Loup, Munjor, and Ord soils. Unlike Barney soils, Albaton soils are fine textured. Boel, Loup, and Ord soils have a mollic epipedon. Boel, Els, and Ord soils are somewhat poorly drained, Inavale soils are somewhat excessively drained, and Munjor soils are well drained. Munjor and Inavale soils generally are at a slightly higher

elevation than Barney soils; in some areas, Inavale soils are closer to the streambank.

Typical pedon of Barney fine sandy loam, 0 to 2 percent slopes, 300 feet south and 2,600 feet west of the center of sec. 32, T. 33 N., R. 23 W.

A1—0 to 7 inches; gray (10YR 5/1) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many fine and medium roots; 1/2-inch thick layer of partly decomposed leaves and grass on the surface; slight effervescence; moderately alkaline; abrupt smooth boundary.

C1—7 to 30 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 5/2) moist; few very thin strata of very fine sand; few coarse prominent yellowish brown (10YR 5/4) mottles; single grained; loose; few fine roots to a depth of 24 inches; mildly alkaline; gradual wavy boundary.

C2—30 to 60 inches; light gray (10YR 7/1) sand, gray (10YR 6/1) moist; single grained; loose; 6 percent gravel, by volume; moderately alkaline.

The solum is 7 to 10 inches thick. The upper part of the A horizon generally is calcareous.

The A horizon has value of 3 to 5, dry, and 2 or 3, moist, and chroma of 1 to 2. It is fine sandy loam, sandy loam, or loamy fine sand.

The C horizon has hue of 10YR; value of 5 to 7, dry, and 4 to 5, moist; and chroma of 1 to 3. It is fine sand and sand and has strata of finer and coarser material. The C horizon is 5 to 10 percent gravel.

Boel series

The Boel series consists of deep, somewhat poorly drained soils on bottom lands. Boel soils formed in sandy and loamy alluvium. Permeability is rapid. The slopes are 0 to 2 percent.

Boel soils commonly are adjacent to Barney, Els, Elsmere, Ipage, and Loup soils. Barney soils are poorly drained. Unlike Boel soils, Els and Ipage soils do not have a mollic epipedon; they generally are at a slightly higher elevation. Elsmere soils have a thicker solum and are less stratified than Boel soils. Ipage soils have better drainage. Loup soils are poorly drained and are at a lower elevation.

Typical pedon of Boel fine sandy loam, 0 to 2 percent slopes, 600 feet north of the center of sec. 4, T. 34 N., R. 18 W.

A1—0 to 7 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, friable; common very fine and fine roots; slight effervescence; clear smooth boundary.

AC—7 to 15 inches; dark grayish brown (10YR 4/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, friable; common very fine and fine roots; slight effervescence; clear smooth boundary.

C1—15 to 24 inches; light gray (10YR 7/2) sand, brown (10YR 5/3) moist; single grained; loose; few very fine roots; thin strata of loamy material; gradual wavy boundary.

C2—24 to 60 inches; light gray (10YR 7/2) sand, pale brown (10YR 6/3) moist; common medium prominent yellowish red (5YR 5/6) mottles; single grained; loose; some strata of loamy material.

The solum is 10 to 20 inches thick. Sand is at a depth of 12 to 48 inches.

The A horizon has value of 3 to 5, dry, and 2 or 3, moist, and chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes loam, sandy loam, and loamy fine sand.

The AC horizon is mainly loamy sand but the range includes loamy fine sand.

The C horizon has hue of 10YR to 5Y; value of 6 or 7, dry, and 5 or 6, moist; and chroma of 2. It has strata of sand, loamy fine sand, sandy loam, fine sandy loam, and loam. Buried horizons are common in the C horizon.

Brocksburg series

The Brocksburg series consists of well drained soils on uplands. Brocksburg soils formed in loamy and loesslike material overlying gravelly sand. Permeability is moderate in the subsoil and very rapid in the underlying material. The slopes are 0 to 1 percent.

Brocksburg soils are similar to Jansen soils. They commonly are adjacent to Jansen, O'Neill, and Meadin soils. Unlike Brocksburg soils, Jansen and O'Neill soils have a mollic epipedon that is less than 20 inches thick; they generally are not so deep to sand and gravel as the Brocksburg soils. Meadin soils have a mollic epipedon that is less than 20 inches thick, do not have an argillic horizon, and are less than 20 inches deep to gravel. Meadin soils typically are steeper than Brocksburg soils and are more than 35 percent gravel in the control section.

Typical pedon of Brocksburg loam, 0 to 1 percent slopes, 1,300 feet east and 65 feet south of the northwest corner of sec. 33, T. 33 N., R. 20 W.

A1—0 to 15 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable; many fine and medium roots; neutral; gradual smooth boundary.

B21t—15 to 21 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; many fine roots; neutral; gradual smooth boundary.

B22t—21 to 27 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; common very fine and fine roots; neutral; clear smooth boundary.

C1—27 to 30 inches; brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; hard, friable; common very fine and fine roots; neutral; abrupt wavy boundary.

IIC2—30 to 60 inches; pale brown (10YR 6/3) gravelly sand, brown (10YR 5/3) moist; single grained; loose; few very fine roots to a depth of 36 inches; neutral.

The solum is 23 to 34 inches thick. The mollic epipedon is 20 to 31 inches thick. Sand and gravel are at a depth of 24 to 40 inches.

The A horizon has value of 3 to 5, dry, and 2 or 3, moist, and chroma of 1 or 2.

The B2t horizon has value of 4 or 5, dry, and 2 or 3, moist, and chroma of 2 or 3. It is mainly clay loam but includes some heavy loam. The B2t horizon is 24 to 33 percent clay.

The C1 horizon ranges from 1 to 12 inches in thickness; it generally is 2 to 4 inches thick. It is neutral to mildly alkaline. In some pedons, there are free carbonates in this horizon.

The IIC2 horizon is mainly medium and coarse sand. Some strata are as much as 40 percent gravel.

Cass series

The Cass series consists of deep, well drained soils on bottom lands. Cass soils formed in mixed sandy and loamy alluvium. Permeability is moderately rapid. The slopes are 0 to 3 percent.

Cass soils are adjacent to Boel, Elsmere, Invale, Loup, Munjor, and Ord soils. Boel soils are somewhat poorly drained; they generally are at the lower elevations on the landscape. Elsmere and Ord soils are somewhat poorly drained. Elsmere and Inavale soils have more sand in the solum than Cass soils. Inavale and Munjor soils do not have a mollic epipedon. Loup soils are poorly drained. All these soils are on bottom lands.

Typical pedon of Cass loam, 0 to 2 percent slopes, 1,000 feet south and 1,700 feet east of the northwest corner of sec. 16, T. 34 N., R. 17 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak fine granular; hard, friable; common very fine and fine roots; abrupt smooth boundary.

A12—6 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; hard, very friable; common very fine roots; clear smooth boundary.

AC—10 to 14 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, very friable; common very fine roots; clear smooth boundary.

C1—14 to 20 inches; pale brown (10YR 6/3) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable; common very fine roots; slight effervescence; abrupt smooth boundary.

Ab—20 to 40 inches; dark gray (10YR 4/1) fine sandy loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, very friable; common very fine roots; strong effervescence; clear smooth boundary.

C2—40 to 60 inches; light brownish gray (10YR 6/2) loamy fine sand, very dark grayish brown (10YR 4/2) moist; few fine faint yellowish brown (10YR 5/6) mottles below a depth of 44 inches; massive; slightly hard, very friable; few very fine roots.

The mollic epipedon is 10 to 20 inches thick. In some pedons, the soil is noncalcareous. In most pedons, the soil is calcareous within a depth of 25 inches.

The A horizon has value of 4 or 5, dry, and 2 or 3, moist, and chroma of 1 or 2. It is dominantly loam, but the range includes fine sandy loam and silt loam. Some pedons have an AC horizon.

The C horizon has value of 6 or 7, dry, and 4 or 5, moist, and chroma of 2 or 3. It is fine sandy loam, loamy fine sand, very fine sand, and sand. Strata of darker sandy or loamy material are common in the C horizon.

Duda series

The Duda series consists of moderately deep, well drained soils on uplands. Duda soils formed in sandy material that weathered from or was blown over sandstone. Permeability is moderately rapid. The slopes range from 0 to 30 percent.

Duda soils commonly are adjacent to Dunday, Holt, Ipage, Tassel, and Valentine soils. Unlike Duda soils, Dunday soils are in slightly raised positions, have a mollic epipedon, and are deep. Holt soils are in positions on the landscape similar to those of Duda soils; unlike Duda soils, they have a mollic epipedon and an argillic horizon. Ipage soils are at a somewhat lower elevation than Duda soils; they are deep and moderately well drained. Tassel soils are shallow and generally are along low ridges. Valentine soils are deep and are on low dunes.

Typical pedon of Duda loamy fine sand, 3 to 6 percent slopes, 600 feet north and 1,200 feet west of the center of sec. 33, T. 34 N., R. 21 W.

A1—0 to 6 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; common very fine and fine roots; neutral; gradual smooth boundary.

AC—6 to 18 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure; soft, very friable; common very fine and fine roots; neutral; clear smooth boundary.

C—18 to 25 inches; light olive gray (5Y 6/2) loamy fine sand, olive (5Y 5/3) moist; weak coarse prismatic structure; soft, very friable; few very fine roots; strong effervescence at a depth of 21 inches; mildly alkaline; gradual wavy boundary.

Cr1—25 to 30 inches; light gray (5Y 7/2) weakly cemented sandstone, light olive gray (5Y 6/2) moist; the sandstone crushes to loamy fine sand; massive breaking to fine and medium sandstone fragments; slightly hard, very friable; few very fine roots; violent effervescence; moderately alkaline; gradual wavy boundary.

Cr2—30 to 60 inches; white (5Y 8/2) sandstone, light olive gray (5Y 6/2) moist; hard, firm; violent effervescence; moderately alkaline.

The solum is 12 to 24 inches thick. Sandstone is at a depth of 20 to 40 inches. The mollic colors extend to a depth of less than 10 inches. The depth to lime ranges from 20 to more than 40 inches.

The A horizon has value of 4 or 5, dry, and 2 or 3, moist, and chroma of 2 or 3.

The AC horizon has value of 5 or 6, dry, and 4 or 5, moist, and chroma of 2 or 3.

The C horizon has hue of 10YR to 5Y, value of 5 to 7, and chroma of 2 or 3.

The Cr horizon ranges from very soft to hard sandstone. In places, it is noncalcareous.

Dunday series

The Dunday series consists of deep, well drained soils on uplands. Dunday soils formed in eolian sand. Permeability is moderately rapid in the upper part of these soils and rapid in the lower part. The slopes range from 0 to 3 percent.

Dunday soils commonly are adjacent to Anselmo, Duda, Elsmere, Manter, O'Neill, and Valentine soils. Anselmo and Manter soils are coarse-loamy in the control section; they generally are at a slightly lower elevation than Dunday soils. Unlike Dunday soils, Duda and Valentine soils do not have a mollic epipedon, and Duda have sandstone at depth of 20 to 40 inches; these soils are on a hummocky to rolling landscape. Elsmere soils are somewhat poorly drained and are at a lower elevation than Dunday soils. O'Neill soils have sand and gravel at depth of 20 to 40 inches, and are in the more level positions on the landscape.

Typical pedon of Dunday loamy fine sand, 0 to 3 percent slopes, in hayland that was once cultivated, 1,050 feet north and 100 feet west of the southeast corner of sec. 34, T. 33 N., R. 19 W.

Ap—0 to 9 inches; dark gray (10YR 4/1) loamy fine sand, black (10YR 2/1) moist; weak coarse subangular blocky structure parting to weak fine granular; soft, very friable; many fine roots; neutral; abrupt smooth boundary.

A12—9 to 15 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure parting to weak fine granular; soft, very friable; many fine roots; neutral; gradual smooth boundary.

AC—15 to 29 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak fine subangular blocky; soft, loose; common fine roots; neutral; gradual smooth boundary.

C—29 to 60 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; single grained; slightly hard, loose; few fine roots; neutral.

The solum is 14 to 30 inches thick. The mollic epipedon is 10 to 18 inches thick.

The A horizon has value of 4 or 5, dry, and 2 or 3, moist, and chroma of 1 or 2.

The C horizon has value of 5 to 7, dry, and 4 to 6, moist, and chroma of 2 or 3. It is mainly loamy fine sand and fine sand.

Some of the Dunday soils in Keya Paha County have layers of loamy material within a depth of 40 inches; others have shale, sandstone, or siltstone at a depth between 40 and 60 inches. These variations are outside the limits defined for the Dunday series; however, they do not significantly affect the use or behavior of these soils.

Els series

The Els series consists of deep, somewhat poorly drained soils on bottom lands and in upland swales. Els soils formed in sandy material deposited by water and wind. Permeability is rapid. The slopes are 0 to 2 percent.

Els soils commonly are adjacent to Barney, Elsmere, Inavale, Ipage, Loup, Ord, and Valentine soils. Unlike Els soils, Barney and Loup soils are poorly drained. Elsmere, Loup, and Ord soils have a mollic epipedon. Invale, Ipage, and Valentine soils have better drainage than the Els soils. Ord soils are coarse-loamy in the control section. Valentine soils are rolling to hilly.

Typical pedon of Els fine sand, 0 to 2 percent slopes, 1,000 feet west of the southeast corner of sec. 15, T. 34 N., R. 19 W.

A1—0 to 7 inches; gray (10YR 5/1) fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular

structure crushing to single grained; soft, loose; many fine and common medium roots; mildly alkaline; clear smooth boundary.

AC—7 to 13 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; single grained; slightly hard, loose; many fine roots; neutral; gradual smooth boundary.

C1—13 to 24 inches; light gray (10YR 7/2) fine sand, pale brown (10YR 6/3) moist; few medium distinct yellowish brown (10YR 5/4) mottles; single grained; slightly hard, loose; few fine roots; neutral; gradual smooth boundary.

C2—24 to 60 inches; white (10YR 8/2) fine sand, pale brown (10YR 6/3) moist; few medium distinct yellowish brown (10YR 5/4) mottles; single grained; soft, loose; few fine and very fine roots to a depth of 30 inches; mildly alkaline.

The solum is 10 to 16 inches thick. The mollic color in the epipedon extends to a depth of less than 10 inches.

The A horizon has value of 4 to 6, dry, and 3 or 4, moist, and chroma of 1 or 2. It is dominantly fine sand, but the range includes loamy sand and loamy fine sand.

The C horizon has hue of 10YR or 2.5Y; value of 6 to 8, dry, and 5 to 7, moist; and chroma of 1 to 3. It has few to many faint to prominent mottles. In some pedons, a buried horizon of darker, finer textured material is in the C2 horizon.

Elsmere series

The Elsmere series consists of deep, somewhat poorly drained soils on bottom lands and stream terraces and in upland swales. Elsmere soils formed in eolian and alluvial fine sand. Permeability is rapid. The slopes are 0 to 2 percent.

Elsmere soils are similar to Els soils. They commonly are adjacent to Ipage, Loup, Ord, and Valentine soils. Unlike Elsmere soils, Els, Ipage, and Valentine soils do not have a mollic epipedon. Ipage and Valentine soils have better drainage than Elsmere soils, and they have hummocky to rolling topography. Ord and Elsmere soils are in similar positions on the landscape, but Ord soils are coarse-loamy in the control section. Loup soils are poorly drained and are in the lowest positions on the landscape.

Typical pedon of Elsmere loamy fine sand, 0 to 2 percent slopes, 2,300 feet south and 250 feet east of the northwest corner of sec. 23, T. 34 N., R. 18 W.

A1—0 to 12 inches; dark gray (10YR 4/1) loamy fine sand, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; many very fine to medium roots; mildly alkaline; clear smooth boundary.

AC—12 to 24 inches; light brownish gray (10YR 6/2) loamy fine sand, dark gray (10YR 4/1) moist; single grained; soft, loose; few very fine and fine roots; mildly alkaline; gradual smooth boundary.

C1—24 to 33 inches; light gray (10YR 7/2) fine sand, gray to light brownish gray (10YR 6/2) moist; common medium prominent yellowish brown (10YR 5/4 and 5/6) mottles; single grained; slightly hard, loose; few very fine roots; mildly alkaline; gradual wavy boundary.

C2—33 to 60 inches; grayish brown (2.5Y 5/2) fine sand, dark grayish brown (2.5Y 4/2) moist; single grained; hard, loose; mildly alkaline.

The solum is 16 to 30 inches thick. The mollic epipedon is 10 to 16 inches thick.

The A horizon has value of 4 or 5, dry, and 2 or 3, moist, and chroma of 1 or 2. It is dominantly loamy fine sand, but the range includes fine sandy loam and loamy sand. The A horizon is neutral to mildly alkaline.

The AC horizon has value of 5 or 6, dry, and 4 or 5, moist, and chroma of 2. It is loamy fine sand, loamy sand, or fine sand.

The C horizon has hue of 10YR or 2.5Y; value of 5 to 7, dry, and 4 to 6, moist; and chroma of 1 to 3. It is neutral to mildly alkaline.

Holt series

The Holt series consists of moderately deep, well drained soils on uplands. Holt soils formed in the residuum of calcareous sandstone. Permeability is moderate. The slopes range from 0 to 11 percent.

Holt soils commonly are adjacent to Duda, Manter, Tassel, Valentine, and Vetal soils. Duda soils are coarser textured in the control section than Holt soils, and they are on hummocks. Manter and Tassel soils are in landscape positions similar to these of Holt soils; however, Manter soils are deep over sandstone, and Tassel soils are shallow over sandstone. Valentine soils are deep, and they are on hummocks and dunes. Vetal soils are in large, level areas; they have a mollic epipedon that is more than 20 inches thick.

Typical pedon of Holt fine sandy loam, 0 to 2 percent slopes, 150 feet east and 800 feet north of the southwest corner of sec. 29, T. 34 N., R. 24 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; many fine and few medium roots; neutral; abrupt smooth boundary.

A12—6 to 10 inches; very dark grayish brown (10YR 3/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to weak medium granular; soft, very friable; many fine and few medium roots; neutral; clear smooth boundary.

B21t—10 to 13 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to weak medium and fine subangular blocky;

slightly hard, firm; common fine and few medium roots; neutral; clear smooth boundary.

B22t—13 to 17 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; common fine roots; mildly alkaline; clear smooth boundary.

B3—17 to 21 inches; brown (10YR 5/3) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure crushing to single grained; few light gray (10YR 7/2) weakly cemented sandstone fragments 3 to 5 mm in diameter; slightly hard, very friable; few fine roots; mildly alkaline; clear smooth boundary.

C—21 to 34 inches; light gray (10YR 7/2) very weakly cemented sandstone, grayish brown (10YR 5/2) moist; the sandstone crushes to light gray (10YR 7/2) loamy fine sand; single grained; few to common hard sandstone fragments 5 to 15 mm in diameter; loose, very friable; few fine roots; violent effervescence; moderately alkaline; clear wavy boundary.

Cr—34 to 60 inches; light gray (10YR 7/1) sandstone, grayish brown (10YR 5/2) moist; massive breaking to fragments of sandstone; very hard, very firm; violent effervescence; moderately alkaline.

The solum is 18 to 28 inches thick. The mollic epipedon is 7 to 18 inches thick; in most pedons, it includes the upper part of the B horizon. The depth to bedrock ranges from 20 to 36 inches. Free carbonates are at a depth of 14 to 30 inches. The solum is neutral or mildly alkaline.

The A horizon has value of 4 or 5, dry, and 2 or 3, moist, and chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes sandy loam and loamy fine sand.

The B2 horizon has value of 4 or 5, dry, and 3 or 4, moist, and chroma of 2 or 3. It typically is fine sandy loam or loam.

The C horizon has value of 6 or 7, dry, and 4 to 6, moist, and chroma of 2 or 3. It is mildly alkaline or moderately alkaline.

Inavale series

The Inavale series consists of deep, somewhat excessively drained soils on bottom lands. Inavale soils formed in recent sandy alluvium. Permeability is rapid. The slopes range from 0 to 11 percent.

Inavale soils commonly are adjacent to Boel, Cass, Els, Elsmere, Marlake, Munjor, and Ord soils. Unlike Inavale soils, Boel, Els, Elsmere, and Ord soils are somewhat poorly drained and Marlake soils are very poorly drained. Cass, Elsmere, and Ord soils have a mollic epipedon, which Inavale soils do not have. Cass and Munjor soils are loamy and are more calcareous than Inavale soils. Boel, Marlake, and Ord soils are in lower positions on the landscape.

Typical profile of Inavale loamy fine sand, 0 to 3 percent slopes, 400 feet north and 2,500 feet west of the center of sec. 32, T. 33 N., R. 23 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; loose, very friable; many fine and medium roots; moderately alkaline; slight effervescence between depths of 3 and 5 inches; clear smooth boundary.

AC—5 to 15 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; single grained; loose; few medium and fine roots; moderately alkaline; gradual wavy boundary.

C1—15 to 44 inches; light gray (10YR 7/2) sand, light brownish gray (10YR 6/2) moist; some thin strata of coarse sand and fine sand; single grained; loose; very few fine roots; moderately alkaline; clear smooth boundary.

C2—44 to 54 inches; light gray (10YR 7/2) gravelly sand, light brownish gray (10YR 6/2) moist; 25 percent gravel; single grained; loose; moderately alkaline; clear smooth boundary.

C3—54 to 60 inches; light gray (10YR 7/1) fine sand, gray (10YR 6/1) moist; single grained; loose; moderately alkaline.

The solum is 10 to 28 inches thick. In most pedons, the soil is mildly alkaline to moderately alkaline.

The A horizon has value of 5 to 7, dry, and 4 or 5, moist, and chroma of 2 or 3. It is dominantly loamy fine sand, but the range includes fine sand, loamy sand, sandy loam, and fine sandy loam. In some pedons, the soil is calcareous.

The AC horizon has value of 5 to 7, dry, and 5 or 6, moist, and chroma of 2 or 3. It is loamy fine sand or fine sand.

The C horizon has value of 6 or 7, dry, and 5 or 6, moist, and chroma of 2 or 3. It is dominantly fine sand or sand, but there are strata of fine sandy loam, coarse sand, and gravel. In some pedons, there are a few faint mottles below a depth of 40 inches.

Ipage series

The Ipage series consists of deep, moderately well drained soils on stream terraces and in upland valleys. Ipage soils formed in sandy alluvium and eolian material. Permeability is rapid. The slopes range from 0 to 3 percent.

Ipage soils commonly are adjacent to Els, Elsmere, Loup, Ord, and Valentine soils. Els, Elsmere, and Ord soils are somewhat poorly drained and are at a slightly lower elevation than Ipage soils. Elsmere, Ord, and Loup soils have a mollic epipedon, which Ipage soils do not have. Loup soils are poorly drained and are at a lower

elevation than Ipage soils. Valentine soils are excessively drained and are on hummocks and dunes.

Typical pedon of Ipage loamy fine sand, 0 to 3 percent slopes, 1,000 feet north and 600 feet west of the southeast corner of sec. 15, T. 34 N., R. 18 W.

A1—0 to 6 inches; dark gray (10YR 4/1) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many medium and fine roots; neutral; clear smooth boundary.

AC—6 to 14 inches; brown (10YR 5/3) fine sand, grayish brown (10YR 5/2) moist; single grained; soft, very friable; many fine and medium roots; neutral; clear smooth boundary.

C1—14 to 30 inches; pale brown (10YR 6/3) fine sand, light brownish gray (10YR 6/2) moist; common coarse prominent yellowish brown (10YR 5/6, moist) mottles; single grained; soft, loose; few fine roots; neutral; gradual smooth boundary.

C2—30 to 60 inches; light gray (10YR 7/2) fine sand, light brownish gray (2.5Y 6/2) moist; common medium prominent yellowish brown (10YR 5/6) mottles; single grained; soft, loose; neutral.

The solum is 6 to 20 inches thick. The A horizon is 3 to 9 inches thick.

The A horizon has value of 4 or 5, dry, and 3 or 4, moist, and chroma of 1 or 2. It is dominantly loamy fine sand, but the range includes loamy sand and fine sand.

The AC horizon has value of 5 or 6, dry, and 4 or 5, moist, and chroma of 2 or 3.

The C horizon has value of 6 or 7, dry, and 5 or 6, moist, and chroma of 2 or 3. There are few to common faint to prominent mottles within a depth of 40 inches. The mottles are brownish yellow or yellowish brown. The C horizon commonly is fine sand, but the range includes sand.

Jansen series

The Jansen series consists of well drained soils on uplands. Jansen soils formed in loamy material and loesslike material overlying sand and gravelly sand. Permeability is moderate in the solum and very rapid in the underlying material. The slopes range from 0 to 6 percent.

Jansen soils are similar to Brocksburg soils. They are adjacent to Brocksburg, Meadin, O'Neill, and Ree soils. Unlike Jansen soils, Brocksburg soils have a mollic epipedon that is more than 20 inches thick. Meadin soils are shallow over gravel and are steeper than Jansen soils. O'Neill soils have more sand and less clay in the B horizon. Ree soils have sand at a depth of more than 40 inches.

Typical pedon of Jansen loam, 0 to 2 percent slopes, in a pasture 50 feet west and 900 feet north of the southeast corner of sec. 25, T. 33 N., R. 21 W.

A1—0 to 9 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine granular structure; hard, friable; many fine and medium roots; neutral; clear smooth boundary.

B21t—9 to 16 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; very hard, firm; slightly acid; many fine and medium roots; neutral; gradual wavy boundary.

B22t—16 to 24 inches; brown (10YR 5/3) clay loam, dark grayish brown (10YR 4/2) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; very hard, firm; clay coatings on the faces of peds; many fine roots; neutral; abrupt wavy boundary.

IIC1—24 to 27 inches; light brownish gray (10YR 6/2) loamy sand, brown (10YR 5/3) moist; single grained; soft, loose; many fine roots; neutral; clear wavy boundary.

IIC2—27 to 60 inches; light gray (10YR 7/2) gravelly sand, very pale brown (10YR 7/3) moist; single grained; soft, loose; few very fine and fine roots in the upper 6 inches; mildly alkaline.

The thickness of the solum and the depth to sand and gravel range from 20 to 36 inches. The mollic epipedon is 7 to 20 inches thick. The soil is neutral in the solum and neutral to mildly alkaline in the C horizon.

The A horizon has value of 4 or 5, dry, and 2 or 3, moist, and chroma of 1 or 2. It is silt loam, loam, fine sandy loam, or sandy loam.

The B2t horizon has value of 4 to 6, dry, and 3 or 4, moist, and chroma of 2 or 3. It is loam or clay loam.

The IIC horizon has value of 6 or 7, dry, and 5 or 6, moist, and chroma of 2 or 3. Between depths of 20 and 27 inches, it ranges from gravelly loam to gravelly sand. Below a depth of 27 inches, it is mainly gravelly sand but includes strata of sand and gravel.

Keota series

The Keota series consists of moderately deep, well drained soils on uplands. Keota soils formed in material that weathered from siltstone. Permeability is moderate. The slopes range from 15 to 60 percent.

The Keota soils in Keya Paha County are in a more humid climate than is typical for the Keota series. This difference, however, does not alter the use or behavior of these soils.

Keota soils commonly are adjacent to Mariaville and Paka soils. Mariaville soils are shallow and generally are steeper than Keota soils. Unlike Keota soils, Paka soils are deep and have a mollic epipedon; they are level to gently sloping.

Typical pedon of Keota silt loam in an area of Mariaville-Keota silt loams, 15 to 60 percent slopes, 1,300 feet south of the center of sec. 1, T. 32 N., R. 22 W.

A1—0 to 5 inches; gray (10YR 6/1) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine and medium roots; violent effervescence; moderately alkaline; clear smooth boundary.
AC—5 to 12 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; many fine and medium roots; violent effervescence; moderately alkaline; clear smooth boundary.
C—12 to 36 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; massive; hard, friable; few fine roots; violent effervescence; moderately alkaline; gradual wavy boundary.
Cr—36 to 60 inches; very pale brown (10YR 7/3) siltstone, pale brown (10YR 6/3) moist; massive breaking to medium and coarse angular blocky fragments; very hard, firm; few fine roots in fractures in the upper few inches; violent effervescence; moderately alkaline.

The solum is 7 to 14 inches thick. The depth to carbonates ranges from 0 to 10 inches. Siltstone is at a depth of 20 to 40 inches.

The A horizon has value of 5 to 7, dry, and 3 to 5, moist, and chroma of 1 to 3. It is loam or silt loam. The A horizon is neutral to mildly alkaline.

The AC horizon has hue of 2.5Y to 10YR; value of 5 to 7, dry, and 4 to 6, moist; and chroma of 1 to 3.

The C horizon has hue of 2.5Y to 7.5YR; value of 6 to 8, dry, and 5 to 7, moist; and chroma of 2 or 3.

Labu series

The Labu series consists of moderately deep, well drained soils on residual uplands. Labu soils formed in clay that weathered from shale. Permeability is slow. The slopes range from 6 to 30 percent.

Labu soils commonly are adjacent to Mariaville, Paka, Sansarc, and Verdel soils. Mariaville and Paka soils formed in material that weathered from siltstone. Mariaville soils are shallow, and Paka soils are deep. Sansarc soils are shallow over bedded shale, and they generally are steeper than Labu soils. Verdel soils are deep and have a mollic epipedon that is 20 to 30 inches thick. They are on the lower toe slopes.

Typical pedon of Labu silty clay, in an area of Labu-Sansarc silty clays, 11 to 30 percent slopes, 150 feet south and 450 feet east of the northwest corner of sec. 9, T. 34 N., R. 17 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure parting to weak fine granular; hard, firm; common fine roots; slight effervescence; moderately alkaline; clear smooth boundary.
B2—5 to 20 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; very hard, very firm; common fine roots; slight effervescence; moderately alkaline; gradual wavy boundary.
C—20 to 36 inches; light olive brown (2.5Y 5/4) clay, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to weak medium and fine subangular blocky; hard, firm; few fine roots; common pressure faces; few distinct concretions of lime; strong effervescence; moderately alkaline; clear wavy boundary.
Cr—36 to 60 inches; light brownish gray (2.5Y 6/2) bedded shale, grayish brown (2.5Y 5/2) moist; massive breaking to moderate medium and coarse platy fragments; very hard, firm; strong effervescence; moderately alkaline.

The solum is 20 to 28 inches thick. The depth to free carbonates is 0 to 12 inches. The surface layer is 4 to 6 inches thick.

The A horizon has hue of 10YR or 2.5Y; value of 4 or 5, dry, and 3 or 4, moist; and chroma of 2 or 3. It is dominantly silty clay, but the range includes clay.

The B horizon has hue of 10YR or 2.5Y; value of 5 or 6, dry, and 4 or 5, moist; and chroma of 2 to 3. The darker colors are in the upper part of the horizon. The B horizon is silty clay or clay.

The C horizon has hue of 10YR or 2.5Y; value of 5 or 6, dry, and 4 or 5, moist; and chroma of 2 to 4. It is clay or shaly clay. In some pedons, fine gypsum crystals are in the C horizon.

The Cr horizon has hue of 10YR or 2.5Y; value of 6 or 7, dry, and 5 or 6, moist; and chroma of 2 to 4. The platy fragments of shale are medium or coarse.

Loup series

The Loup series consists of deep, very poorly drained and poorly drained soils on bottom lands. Loup soils formed in sandy and loamy alluvium. Permeability is rapid. The slopes are 0 to 2 percent.

Loup soils commonly are adjacent to Albaton, Els, Elsmere, Inavale, Marlake, and Ord soils. Unlike Loup soils, Albaton soils have clay in the control section. Els, Elsmere, and Ord soils are somewhat poorly drained, and Inavale soils are somewhat excessively drained; these soils generally are at a slightly higher elevation than Loup soils. Marlake soils do not have a mollic epipedon; they are at a lower elevation than Loup soils and are covered with water throughout much of the year.

Typical pedon of Loup fine sandy loam, 0 to 2 percent slopes, 2,100 feet south and 500 feet east of the northwest corner of sec. 36, T. 34 N., R. 21 W.

A1—0 to 11 inches; dark gray (10YR 4/1) fine sandy loam, very dark brown (10YR 2/2) moist; weak fine

granular structure; hard, friable; common very fine and fine roots; a layer of partly decayed leaves and stems is on the surface; effervescence; moderately alkaline; clear smooth boundary.

AC—11 to 14 inches; light brownish gray (10YR 6/2) loamy fine sand, grayish brown (10YR 5/2) moist; few fine faint pale brown (10YR 6/3) mottles; single grained; slightly hard, very friable; common fine roots; moderately alkaline; gradual smooth boundary.

C1—14 to 31 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; single grained; soft, loose, few fine roots; moderately alkaline; clear smooth boundary.

Ab—31 to 37 inches; light gray (10YR 6/1) loamy fine sand, gray (10YR 5/1) moist; single grained; slightly hard, very friable; few fine roots; slight effervescence; moderately alkaline; gradual smooth boundary.

C2—37 to 60 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; many fine prominent brownish yellow (10YR 6/6) mottles; single grained; slightly hard, loose; slight effervescence; moderately alkaline.

The solum is 10 to 20 inches thick. The mollic epipedon is 7 to 16 inches thick.

The A horizon has value of 3 or 4, dry, and 2 or 3, moist, and chroma of 1 or 2. It ranges from neutral to moderately alkaline.

The AC horizon, where present, is transitional in color and texture to the C horizon.

The C horizon has hue of 10YR or 2.5Y; value of 6 or 7, dry, and 5 or 6, moist; and chroma of 1 or 2. It is mildly alkaline to moderately alkaline. A buried A horizon is in some pedons.

Mantor series

The Manter series consists of deep, well drained, soils on uplands. Manter soils formed in eolian loamy and sandy material overlying sandstone. Permeability is moderately rapid. The slopes range from 0 to 17 percent.

The Manter soils in Keya Paha County are in a humid climate, which is not typical for the Manter series. This difference, however, does not affect the use or behavior of these soils.

Manter soils commonly are adjacent to Anselmo, Dunday, Holt, O'Neill, Vetal, and Wewela soils. Unlike Manter soils, Anselmo, Dunday, O'Neill, and Vetal soils do not have an argillic horizon. Dunday soils are on hummocks. O'Neill soils are at a slightly higher elevation than Manter soils, and Wewela soils are at a lower elevation. Vetal and Holt soils are in positions on the landscape similar to those of Manter soils. O'Neill soils have gravelly sand at a depth of 20 to 40 inches, Holt soils have sandstone, and Wewela soils have shale. Vetal soils have a mollic epipedon that is more than 20 inches thick.

Typical pedon of Manter loamy fine sand, 0 to 3 percent slopes, 150 feet north and 75 feet east of the southwest corner of sec. 1, T. 33 N., R. 21 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, loose; common fine roots; neutral; clear smooth boundary.

A3—6 to 12 inches; brown (10YR 5/3) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak fine granular; soft, very friable; common fine roots; neutral; gradual smooth boundary.

B21t—12 to 17 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; common fine roots; neutral; gradual smooth boundary.

B22t—17 to 24 inches; pale brown (10YR 6/3) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, firm; few very fine roots; neutral; gradual wavy boundary.

C—24 to 48 inches; light gray (10YR 7/2) loamy fine sand, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to single grained; soft, loose; few fine roots to a depth of 36 inches; mildly alkaline; gradual wavy boundary.

Cr—48 to 60 inches; white (5Y 8/2) weathered sandstone, light brownish gray (2.5Y 4/2) moist; the sandstone crushes to loamy fine sand; massive; hard, firm; mildly alkaline.

The solum is more than 15 inches thick. Calcareous material is at a depth of 20 to 60 inches.

The A horizon has value of 4 or 5, dry, and 2 or 3, moist, and chroma of 2 or 3. It is dominantly loamy fine sand, but the range includes fine sandy loam or sandy loam.

The B2 horizon has value of 5 to 7, dry, and 3 to 6, moist, and chroma of 2 to 4. It is dominantly fine sandy loam, but the range includes sandy loam.

The C horizon has value of 6 to 8, dry, and 5 or 6, moist, and chroma of 2 or 3. It is loamy sand, loamy fine sand, or fine sand. In some pedons, below a depth of 40 inches, the C horizon is soft, weathered or hard, cemented sandstone.

Mariaville series

The Mariaville series consists of shallow, well drained soils on uplands. Mariaville soils formed in silty material that weathered from siltstone. Permeability is moderate. The slopes range from 3 to 60 percent.

Mariaville soils commonly are adjacent to Keota and Paka soils. Unlike Mariaville soils, Keota soils are

moderately deep; they generally are slightly lower on the slopes or are on smoother slopes. Paka soils are deep and have a mollic epipedon and an argillic horizon; they generally are lower on the slopes and are on smoother slopes or concave slopes.

Typical pedon of Mariaville silt loam, in an area of Mariaville-Keota silt loams, 15 to 60 percent slopes, 1,600 feet south of the center of sec. 1, T. 32 N., R. 22 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many fine roots; strong effervescence; mildly alkaline; gradual smooth boundary.

AC—4 to 10 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak coarse blocky structure parting to weak medium and fine subangular blocky; soft, very friable; common fine and few large roots; strong effervescence (14 percent calcium carbonate); moderately alkaline; gradual smooth boundary.

C—10 to 16 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; soft, very friable; common fine roots; strong effervescence (8 percent calcium carbonate); moderately alkaline; abrupt wavy boundary.

Cr—16 to 60 inches; very pale brown (10YR 7/3) siltstone, brown (10YR 5/3) moist; moderate coarse platy fragments; hard, friable; common fine roots between fragments in the upper few inches; strong effervescence (5 percent calcium carbonate); moderately alkaline.

The solum is 7 to 14 inches thick. Siltstone is at a depth of 10 to 20 inches.

The A horizon has value of 3 to 5, dry, and 2 or 3, moist, and chroma of 2. It is loam and silt loam. The A horizon is mildly alkaline to moderately alkaline.

The AC horizon has hue of 2.5Y or 10YR; value of 4 to 6, dry, and 3 to 5, moist; and chroma of 2 or 3.

The C horizon has hue of 7.5YR to 2.5Y; value of 5 to 7, dry, and 4 to 6, moist; and chroma of 2 to 4. It is mildly alkaline to moderately alkaline.

Marlake series

The Marlake series consists of deep, very poorly drained soils on low bottom lands and in upland depressions. Marlake soils formed in alluvial sand. Permeability is rapid. The slopes are 0 to 1 percent.

Marlake soils commonly are adjacent to Barney, Inavale, Ipage, and Loup soils. Barney and Loup soils generally have better drainage than Marlake soils; they are not covered with water during the growing season in the spring. Inavale soils are somewhat excessively drained, and Ipage soils are moderately well drained to well drained. All these soils are at a higher elevation than Marlake soils.

Typical pedon of Marlake loamy fine sand, 0 to 1 percent slopes, 2,000 feet east of the southwest corner of sec. 16, T. 34 N., 23 W.

A11—0 to 4 inches; dark gray (5Y 4/1) loamy fine sand, black (5Y 2/1) moist; weak fine granular structure; soft, very friable; many fine and medium roots; a layer of partly decayed leaves and stems is on the surface; snail shells; strong effervescence; moderately alkaline; clear wavy boundary.

A12—4 to 8 inches; gray (5Y 5/1) loamy fine sand, dark olive gray (5Y 3/2) moist; massive; slightly hard, friable; many fine and common medium roots; snail shells; strong effervescence; moderately alkaline; clear wavy boundary.

C1—8 to 36 inches; light gray (5Y 7/2) stratified loamy sand and fine sand, light olive gray (5Y 6/2) moist; few fine prominent yellow mottles (10YR 7/6); single grained; slightly hard, loose; snail shells; common fine and medium roots to a depth of 18 inches; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—36 to 60 inches; light gray (2.5Y 7/2) fine sand, light brownish gray (2.5Y 6/2) moist; single grained; slightly hard, loose; strong effervescence; mildly alkaline.

The solum is 6 to 24 inches thick. The mollic color extends to a depth of 6 to 10 inches. These soils commonly have snail shells throughout the profile.

The A horizon has hue of 10YR to 5Y; value of 4 or 5, dry, and 2 or 3, moist; and chroma of 1 or 2. It is loamy sand, loamy fine sand, or fine sandy loam. The A horizon ranges from neutral to moderately alkaline.

The AC horizon, where present, is transitional to the C horizon.

The C horizon has hue of 10YR to 5Y; value of 5 to 7, dry, and 4 to 6, moist; and chroma of 1 to 3. Strata of finer and coarser textured material are common in the C horizon. The mottles range from faint to prominent and from brown to yellow.

Meadin series

The Meadin series consists of excessively drained soils on gravelly uplands, low ridges, slope breaks, and foot slopes. Meadin soils formed in loamy material overlying sandy and gravelly material. Permeability is rapid. The slopes range from 3 to 30 percent.

Meadin soils commonly are adjacent to Anselmo, O'Neill, Simeon, and Valentine soils. Unlike Meadin soils, Anselmo soils are deep and do not have gravel within a depth of 40 inches. O'Neill soils are moderately deep and have sand and gravelly sand at a depth between 20 and 36 inches. Simeon soils are in positions on the

landscape similar to those of Meadin soils; however, they have less gravel and more coarse sand within a depth of 20 inches. Valentine soils are deep, sandy soils on dunes and hummocks.

Typical pedon of Meadin gravelly sandy loam, 3 to 30 percent slopes, 2,000 feet south and 50 feet east of the northwest corner of sec. 28, T. 35 N., R. 17 W.

A1—0 to 7 inches; dark gray (10YR 4/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; loose; 10 to 15 percent fine medium gravel; many fine and few medium roots; neutral; clear smooth boundary.

AC—7 to 11 inches; brown (10YR 4/3) gravelly loamy sand, dark brown (10YR 3/3) moist; single grained; loose; many fine roots; neutral; clear smooth boundary.

IIC1—11 to 33 inches; light brownish gray (10YR 6/2) very gravelly sand, brown (10YR 5/3) moist; single grained; loose; 50 percent gravel, by volume; few fine roots to a depth of 24 inches; neutral; clear smooth boundary.

IIC2—33 to 60 inches; light gray (10YR 7/2) sand, pale brown (10YR 6/3) moist; single grained; loose; neutral.

The solum is 7 to 19 inches thick. The mollic epipedon generally is 10 to 14 inches thick; in some places where the soil is loam or sandy loam, the mollic epipedon is only about 7 inches thick.

The A horizon has value of 4 or 5, dry, and 2 or 3, moist, and chroma of 1 or 2. It is loam, sandy loam, gravelly sandy loam, loamy fine sand, or loamy sand. It ranges from medium acid to neutral.

The AC horizon has value of 4 to 6, dry, and 3 or 4, moist, and chroma of 2 or 3. It is loose sandy loam, gravelly sandy loam, loamy sand, or gravelly loamy sand.

The IIC horizon has value of 6 or 7, dry, and 5 or 6, moist, and chroma of 2 to 4. It consists of stratified sand and gravel and is 35 to 70 percent gravel, by volume. In some areas, sandstone is at a depth below 40 inches.

Munjor series

The Munjor series consists of deep, well drained soils on bottom lands. Munjor soils formed in loamy and sandy alluvium. Permeability is moderately rapid. The slopes are 0 to 2 percent.

Munjor soils commonly are adjacent to Boel and Inavale soils. Unlike Munjor soils, Boel soils are somehwat poorly drained, and Inavale soils have a sandy control section.

Typical pedon of Munjor fine sandy loam, 0 to 2 percent slopes, 500 feet west and 1,000 feet north of the center of sec. 32, T. 33 N., R. 23 W.

A1—0 to 6 inches; gray (10YR 6/1) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; common fine and medium roots; slight effervescence; mildly alkaline; clear smooth boundary.

C1—6 to 24 inches; gray (10YR 6/2 and 7/2) fine sandy loam, dark gray (10YR 4/1) moist; weak coarse subangular blocky structure; slightly hard, very friable; common fine and medium roots; strong effervescence; moderately alkaline; clear smooth boundary.

C2—24 to 36 inches; gray (10YR 6/2) stratified loam and fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium and fine subangular blocky structure; slightly hard, friable; common fine roots; violent effervescence; moderately alkaline; clear smooth boundary.

C3—36 to 60 inches; light gray (10YR 7/2) loamy fine sand, gray (10YR 6/2) moist; single grained; soft, loose; few fine roots; violent effervescence; moderately alkaline.

The solum is 4 to 14 inches thick. The mollic colors do not extend to a depth of more than 6 inches. These soils are mildly alkaline to moderately alkaline throughout.

The A horizon has value of 5 or 6, dry, and 3 or 4, moist, and chroma of 1 or 2. It generally is fine sandy loam, but the range includes sandy loam, loamy sand, and loam.

The C horizon has value of 5 to 7, dry, and 4 to 6, moist, and chroma of 2. It is stratified.

O'Neill series

The O'Neill series consists of well drained soils on uplands and high stream terraces. O'Neill soils formed in loamy material overlying sand and gravel. Permeability is moderately rapid in the solum and very rapid in the underlying material. Slopes are 0 to 9 percent.

O'Neill soils commonly are adjacent to Jansen, Meadin, Simeon, and Valentine soils. Unlike O'Neill soils, Jansen soils have a fine-loamy control section. Meadin and Simeon soils have sand and gravel at a depth of less than 20 inches. Meadin soils are more than 35 percent gravel. Valentine soils are deep, do not have a mollic epipedon, and are on dunes and hummocks.

Typical pedon of O'Neill fine sandy loam, 0 to 2 percent slopes, 2,600 feet north and 50 feet west of the southeast corner of sec. 26, T. 33 N., R. 20 W.

A11—0 to 6 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; many very fine and fine roots; slightly acid; clear smooth boundary.

A12—6 to 13 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse medium and fine subangular blocky structure; slightly hard, very friable; common very fine and fine roots; slightly acid; gradual smooth boundary.

B2—13 to 24 inches; brown (10YR 5/3) heavy sandy loam, dark brown (10YR 4/3) moist; weak to moderate coarse medium and fine subangular blocky structure; hard, friable; few very fine roots; slightly acid; clear wavy boundary.

IIC—24 to 60 inches; pale brown (10YR 6/3) gravelly sand, brown (10YR 5/3) moist; single grained; loose; slightly acid.

The solum is 20 to 36 inches thick. The mollic epipedon is 7 to 20 inches thick. Sand and gravel are at a depth of 20 to 36 inches. These soils are slightly acid to neutral throughout the profile.

The A horizon has value of 4 or 5, dry, and 2 or 3, moist, and chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes loam and loamy fine sand.

The B horizon has value of 4 or 5, dry, and 3 or 4, moist, and chroma of 2 to 4. It is fine sandy loam or sandy loam.

The IIC horizon has value of 6 or 7, dry, and 5 or 6, moist, and chroma of 3 or 4.

Onita series

The Onita series consists of deep, moderately well drained soils in upland swales. Onita soils formed in silty, calcareous loess. Permeability is moderately slow. The slopes are 0 to 1 percent.

Onita soils commonly are adjacent to Brocksburg, Jansen, Labu, Ree, Reliance, and Verdel soils. Unlike Onita soils, Brocksburg and Jansen soils are less than 40 inches deep over gravelly sand. Labu soils are less than 40 inches deep over shale and do not have a mollic epipedon. Ree soils have less clay in the argillic horizon than Onita soils, and they have a mollic epipedon that is less than 20 inches thick. Reliance soils are in slightly higher positions and have a mollic epipedon that is less than 20 inches thick. Verdel soils do not have an argillic horizon; they generally are on toe slopes of the shale hills.

Typical pedon of Onita silt loam, 0 to 1 percent slopes, 100 feet west of the southeast corner of sec. 11, T. 34 N., R. 17 W.

A1—0 to 16 inches; very dark gray (10YR 3/1) silt loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; many very fine and fine roots; neutral; clear smooth boundary.

B21t—16 to 25 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to moderate medium and fine subangular blocky; hard, firm; common very fine roots; mildly alkaline; clear wavy boundary.

B22t—25 to 36 inches; dark grayish brown (10YR 4/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; common very fine roots; slight effervescence; moderately alkaline; clear wavy boundary.

C—36 to 60 inches; brown (10YR 5/3) silt loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few very fine roots; strong effervesence; moderately alkaline.

The solum is 25 to 48 inches thick. The mollic epipedon is 20 to 40 inches thick. The depth to free carbonates ranges from 24 to more than 40 inches.

The A horizon has value of 3 or 4, dry, and 2 or 3, moist, and chroma of 1 or 2. It generally is silt loam, but in some pedons it is loam or silty clay loam.

The B2t horizon has value of 3 to 5, dry, and 2 to 4, moist, and chroma of 1 to 3. It is dominantly silty clay loam, but the range includes clay loam and silty clay.

The C horizon has value of 5 or 6, dry, and 4 or 5, moist, and chroma of 2 or 3.

Ord series

The Ord series consists of deep, somewhat poorly drained soils on bottom lands and stream terraces and in upland valleys. Ord soils formed in stratified loamy and sandy alluvium. Permeability is moderately rapid. The slopes are 0 to 2 percent.

Ord soils commonly are adjacent to Barney, Boel, Cass, Els, Elsmere, Ipage, Inavale, and Loup soils. Unlike Ord soils, Barney and Loup soils are poorly drained; they are in the lowest positions on the landscape. Boel, Els, and Elsmere soils are in landscape positions similar to those of Ord soils; however, they have a coarse-textured control section, and Els soils do not have a mollic epipedon. Cass, Ipage, and Inavale soils have better drainage than Ord soils; in addition, Ipage and Inavale soils have a coarser textured control section.

Typical pedon of Ord fine sandy loam, in an area of Ord-Loup fine sandy loams, 0 to 2 percent slopes, 200 feet north and 200 feet east of the southwest corner of sec. 34, T. 35 N., R. 24 W.

A1—0 to 12 inches; gray (10YR 5/1) fine sandy loam, black (10YR 2/1) moist; weak fine granular structure; hard, friable; many fine and medium roots; violent effervescence; moderately alkaline; gradual smooth boundary.

AC—12 to 24 inches; light gray (2.5YR 6/1) loam, gray (10YR 5/1) moist; weak coarse blocky structure parting to weak fine subangular blocky; slightly hard, friable; common fine roots; violent effervescence; moderately alkaline; gradual smooth boundary.

C1—24 to 36 inches; light gray (10YR 7/1) fine sandy loam, light brownish gray (10YR 6/2) moist; single grained; slightly hard, very friable; few very fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—36 to 60 inches; light gray (10YR 7/1) fine sand, light brownish gray (10YR 6/2) moist; some strata of finer and coarser soil material; few fine faint light yellowish brown (10YR 6/4) iron stains; single grained; soft, very friable; strong effervescence; moderately alkaline.

The solum is 20 to 30 inches thick. It commonly is directly underlain by sand. The mollic epipedon is 10 to 20 inches thick.

The A horizon has value of 3 to 5, dry, and 2 or 3, moist, and chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes loam.

The AC horizon has hue of 2.5Y or 10YR; value of 5 or 6, dry, and 4 or 5, moist; and chroma of 0 to 2.

The C1 horizon has hue of 2.5Y or 10YR; value of 5 to 7, dry, and 4 to 6, moist; and chroma of 1 or 2. It ranges from fine sandy loam to fine sand.

The C2 horizon has hue of 2.5Y or 10YR; value of 6 to 8, dry, and 5 to 7, moist, and chroma of 1 to 3. Textures include loamy sand, fine sand, and sand, and there are strata of finer and coarser textured material.

Paka series

The Paka series consists of deep, well drained soils on uplands and high stream terraces. Paka soils formed in loamy or silty material that weathered from siltstone. Permeability is moderate. The slopes range from 0 to 30 percent.

Paka soils commonly are adjacent to Manter, Mariaville, and Wewela soils. Manter soils have more sand in the control section than Paka soils; they generally are on similar or slightly higher positions on the landscape. Mariaville soils do not have a mollic epipedon and are less than 20 inches deep over siltstone; they are steeper than Paka soils. Wewela soils are less than 40 inches deep over shale and have less silt in the control section than Paka soils; they are nearly level to strongly sloping and are on uplands.

Typical pedon of Paka loam, 0 to 1 percent slopes, 2,000 feet west and 1,200 feet north of the southeast corner of sec. 20, T. 34 N., R. 17 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, black (10YR 2/2) moist; weak fine granular structure; hard, very friable; common very fine and fine roots; neutral; abrupt smooth boundary.

A12—7 to 14 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, very friable; common very fine and fine roots; neutral; clear smooth boundary.

B21t—14 to 19 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; very hard, friable; common very fine roots; mildly alkaline; clear smooth boundary.

B22t—19 to 25 inches; pale brown (10YR 6/3) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; common very fine roots; mildly alkaline; clear smooth boundary.

B3—25 to 30 inches; light gray (10YR 7/2) silt loam, pale brown (10YR 6/3) moist; massive; hard, very friable; few very fine roots; mildly alkaline; clear smooth boundary.

C—30 to 41 inches; white (2.5Y 8/2) silt loam, light gray (2.5Y 7/2) moist; massive; hard, very friable; strong effervescence; moderately alkaline; gradual wavy boundary.

Cr—41 to 60 inches; white (2.5Y 8/2) siltstone, light gray (2.5Y 7/2) moist; the siltstone crushes to silt loam; massive; very hard, friable; strong effervescence; strongly alkaline.

The solum is 20 to 30 inches thick. The mollic epipedon is 7 to 19 inches thick. The depth to carbonates ranges from 16 to 30 inches. The siltstone is at a depth of 40 to 60 inches; in some pedons there are siltstone fragments at a depth of less than 40 inches.

The A horizon has value of 3 or 4, dry, and 2 or 3, moist, and chroma of 2 or 3. It is fine sandy loam or loam.

The B2t horizon has hue of 10YR and 2.5Y; value of 5 to 7, dry, and 4 to 6, moist; and chroma of 2 or 3. It is silty clay loam, silt loam, or clay loam. In some pedons, the lower part of the B2t horizon is calcareous.

The C horizon has hue of 7.5YR, 10YR, or 2.5Y; value of 7 or 8, dry, and 6 or 7, moist; and chroma of 2 to 4.

The Cr horizon is mildly alkaline to moderately alkaline.

Paka fine sandy loam, 0 to 2 percent slopes, has more sand in the upper part of the B2t horizon than is typical for the Paka series. This difference, however, does not affect the use or behavior of this soil.

Ree series

The Ree series consists of deep, well drained soils on uplands. Ree soils formed in loamy material that is underlain by sandy material. Permeability is moderate. The clayey substratum phase (map unit R6) has very slowly permeable shale at a depth of 40 to 60 inches. The slopes are 0 to 3 percent.

Ree soils commonly are adjacent to Jansen, Manter, Onita, Reliance, Verdel, Vetal, and Wewela soils. Unlike Ree soils, Jansen soils are moderately deep over sand and gravel. Manter and Vetal soils have a coarse-loamy control section. Onita, Reliance, and Verdel soils have a fine control section. Onita and Vetal soils have a mollic epipedon that is more than 20 inches thick. Wewela soils have a fine-loamy control section and have bedded shale at a depth between 20 to 40 inches. All these soils are on the same landscape as Ree soils.

Typical pedon of Ree loam, 1 to 3 percent slopes, 1,850 feet south and 1,300 feet east of the center of sec. 30, T. 35 N., R. 17 W.

A1—0 to 13 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to weak fine granular; slightly hard, friable; many very fine to medium roots; neutral; gradual smooth boundary.

B2t—13 to 25 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; common fine roots; neutral; gradual smooth boundary.

C1ca—25 to 54 inches; light brownish gray (10YR 6/2) clay loam, weak medium and coarse subangular blocky structure; slightly hard, friable; very fine and few fine roots; common fine segregations of lime; violent effervescence; moderately alkaline; gradual smooth boundary.

IIC2—54 to 60 inches; pale brown (10YR 6/3) loamy sand, grayish brown (10YR 5/2) moist; 10 to 15 percent gravel; single grained; slight effervescence; moderately alkaline.

The solum is 20 to 30 inches thick. The mollic epipedon is 7 to 19 inches thick. The depth to carbonates ranges from 15 to 35 inches but typically is 20 to 30 inches.

The A horizon has value of 3 to 5, dry, and 2 or 3, moist, and chroma of 1 or 2. It commonly is loam, but in some pedons it is silt loam.

The B2t horizon has value of 4 or 5, dry, and 3 or 4 moist, and chroma of 2. It commonly is clay loam, but in some pedons it is silty clay loam, loam, or sandy clay loam.

The C horizon is fine sandy loam, loam, clay loam, and sandy clay loam to a depth of more than 40 inches. Below that, it is sandy loam, loamy sand, or sand. In some places, the lower part of the C horizon is 5 to 30 percent gravel. In some areas shale is at a depth below 40 inches.

Reliance series

The Reliance series consists of deep, well drained soils on uplands. Reliance soils formed in silty, loesslike material. Permeability is moderately slow. The slopes range from 2 to 6 percent.

Reliance soils commonly are adjacent to Anselmo, Jansen, Labu, Manter, O'Neill, Onita, Ree, and Verdel soils. Unlike Reliance soils, Anselmo, Manter, and O'Neill soils have a coarse-loamy control section. Ree soils have a fine-loamy control section. Jansen and O'Neill soils have sand and gravel at a depth between 20 and 40 inches. Labu soils do not have a mollic epipedon and have bedded shale at a depth of 20 to 40 inches. Onita soils have a mollic epipedon that is more than 20 inches thick. Verdel soils have more clay throughout the profile than Reliance soils, and they do not have an argillic horizon. All these soils are in the same landscape positions as Reliance soils except for Onita soils, which are in swales.

Typical pedon of Reliance silt loam, 2 to 6 percent slopes, 500 feet east and 1,200 feet north of the center of sec. 4, T. 34 N., R. 17 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, firm; many very fine and fine roots; neutral; abrupt smooth boundary.

A12—5 to 11 inches; very dark gray (10YR 3/1) silt loam, very dark brown (10YR 2/2) moist; moderate medium subangular blocky structure; hard, firm; common very fine and fine roots; neutral; clear smooth boundary.

B2t—11 to 27 inches; brown (10YR 5/3) silty clay loam, dark grayish brown (10YR 4/2) moist; few medium distinct yellowish brown (10YR 5/6) mottles; strong coarse prismatic structure parting to medium subangular blocky; very hard, firm; common very fine roots; violent effervescence at a depth of 22 inches; mildly alkaline; clear smooth boundary.

B3—27 to 37 inches; brown (10YR 5/3) silty clay loam, dark grayish brown (10YR 4/2) moist; few fine faint light yellowish brown (10YR 6/4) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; common very fine roots; violent effervescence; moderately alkaline; gradual wavy boundary.

Cca—37 to 48 inches; brown (10YR 5/3) silt loam, grayish brown (10YR 5/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm; few very fine roots; common fine segregations of lime; violent effervescence; moderately alkaline; gradual wavy boundary.

IIC2—48 to 60 inches; mixed sand and gravel.

The solum is 24 to 40 inches thick. The mollic epipedon is 10 to 18 inches thick. Free carbonates are at a depth between 18 and 36 inches.

The A horizon has value of 4 or 5, dry, and 2 or 3, moist, and chroma of 1 or 2. It is dominantly silt loam, but the range includes silty clay loam.

The B2t horizon has value of 4 or 5, dry, and 2 to 4, moist, and chroma of 2 or 3. It typically is silty clay loam, but the range includes silty clay that averages 35 to 43 percent clay.

The B3 horizon has value of 5 to 7, dry, and 4 to 6, moist, and chroma of 2 or 3. It is silty clay loam or silt loam.

The C horizon has value of 6 or 7, dry, and 5 or 6, moist, and chroma of 2 or 3. It is silt loam to a depth of

40 inches or more; below that, it is sandy loam or gravelly sand. In places shale is at a depth below 40 inches.

Ronson series

The Ronson series consists of moderately deep, well drained soils on uplands. The upper part of these soils formed in loamy eolian material, and the lower part formed in calcareous residuum of soft sandstone. Permeability is moderately rapid. The slopes range from 0 to 30 percent.

Ronson soils commonly are adjacent to Duda, Holt, Tassel, and Valentine soils. Unlike Ronson soils, Duda and Valentine soils are on hummocks and do not have a mollic epipedon; they are coarser textured than Ronson soils. In addition, Valentine soils are deep. Holt soils have a B horizon. Tassel soils have sandstone at a depth of less than 20 inches.

Typical pedon of Ronson fine sandy loam, in an area of Ronson-Tassel fine sandy loams, 0 to 3 percent slopes, 1,700 feet west and 10 feet south of the northeast corner of sec. 11, T. 34 N., R. 23 W.

A11—0 to 7 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; mildy alkaline; clear smooth boundary.

A12—7 to 13 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine subangular blocky structure parting to weak fine granular; slightly hard, friable; mildy alkaline; clear smooth boundary.

AC—13 to 18 inches; light gray (10YR 7/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium and fine subangular blocky structure; slightly hard, friable; slight effervescence on the fragments of sandstone in the lower part of the horizon; clear wavy boundary.

C—18 to 25 inches; white (10YR 8/2) loamy sand that has fragments of sandstone, light brownish gray (10YR 6/2) moist; massive; slightly hard, friable; violent effervescence; moderately alkaline; abrupt wavy boundary.

Cr—25 to 60 inches; white (10YR 8/2) sandstone, light brownish gray (10YR 6/2) moist; massive weathered sandstone; violent effervescence.

The solum is 12 to 18 inches thick. The mollic epipedon is 7 to 13 inches thick. Sandstone is at a depth of 20 to 40 inches. The depth to free carbonates ranges from near the surface to a depth of 20 inches.

The A horizon has value of 3 to 5, dry, and 2 or 3, moist, and chroma of 1 or 2. It commonly is fine sandy loam or loamy fine sand, but the range includes sandy loam.

The AC horizon has value of 5 to 7, dry, and 4 to 6, moist, and chroma of 2 or 3. It is fine sandy loam or sandy loam. The AC horizon is neutral to moderately alkaline.

The C horizon has value of 6 to 8, dry, and 5 to 7, moist, and chroma of 2 or 3.

The Cr horizon is generally weathered sandstone that ranges from soft to strongly cemented as depth increases.

Sansarc series

The Sansarc series consists of shallow, well drained soils on residual uplands. Sansarc soils formed in clayey, weathered shale. Permeability is slow. The slopes range from 11 to 40 percent.

Sansarc soils commonly are adjacent to Labu soils. Unlike Sansarc soils, Labu soils are more than 20 inches deep over bedded shale; they are on the smoother part of slopes and generally are lower in elevation than Sansarc soils.

Typical pedon of Sansarc silty clay, 20 to 40 percent slopes, 700 feet south and 800 feet west of the northeast corner of sec. 3, T. 34 N., R. 18 W.

A1—0 to 4 inches; dark grayish brown (2.5Y 4/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable; common fine and medium roots; few cherty fragments of shale on the surface; moderately alkaline; clear smooth boundary.

C1—4 to 10 inches; grayish brown (2.5Y 5/2) clay, grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure; hard, firm; common very fine and fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

C2—10 to 14 inches; light brownish gray (2.5Y 6/2) clay, olive brown (2.5Y 4/4) moist; massive breaking to coarse platy fragments; some fragments of shale; hard, firm; few fine roots in bedding planes; violent effervescence; moderately alkaline; clear wavy boundary.

Cr—14 to 60 inches; light gray (2.5Y 7/2) bedded shale; massive breaking to fragments of shale; hard, firm; few fine roots between platy fragments to a depth of 36 inches; violent effervescence; moderately alkaline.

The depth of bedrock typically is 8 to 15 inches but ranges from 4 to 20 inches. The depth to free carbonates ranges from 0 to 6 inches.

The A horizon has value of 4 to 6, dry, and 3 to 5, moist, and chroma of 2. It is dominantly silty clay or clay.

The C horizon has value of 4 to 8, dry, and 3 to 6, moist, and chroma of 2 to 4.

The C horizon consists of weathered bedded shale in varying degrees of hardness.

Schamber series

The Schamber series consists of excessively drained soils on gravelly ridgetops in blufflike areas along drainageways. Schamber soils formed in gravelly, loamy material over sand and gravel. Permeability is rapid. The slopes range from 11 to 30 percent.

The Schamber soils in Keya Paha County are in a more humid climate than is typical for the Schamber series. In addition, they have more fragments of soft limestone than is typical; however, this feature differs from place to place. In some places, the gravel consists predominantly of limestone, and in others it consists predominantly of quartz. These differences do not affect the use or behavior of these soils.

Schamber soils commonly are adjacent to Labu and Sansarc soils, which formed in material that weathered from shale. Unlike Schamber soils, Sansarc soils are less than 20 inches deep over bedded shale. Labu soils have bedded shale at a depth of 20 to 40 inches.

A typical pedon of Schamber gravelly sandy loam, 11 to 30 percent slopes (fig. 15), 1,200 feet east of the center of sec. 34, T. 35 N., R. 18 W.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many fine and medium roots; 30 percent chert; strong effervescence; moderately alkaline; clear smooth boundary.

Clca—4 to 18 inches; grayish brown (10YR 5/2) very gravelly sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure parting to granular; soft, loose; few very fine and fine roots; 52 percent chert; strong effervescence; moderately alkaline; gradual wavy boundary.

C2ca—18 to 60 inches; very pale brown (10YR 7/3) very gravelly sand, pale brown (10YR 6/3) moist; massive; few very fine roots to a depth of 36 inches; 52 percent chert and gravel; loose; violent effervescence; moderately alkaline.

The solum is 4 to 6 inches thick. The depth to free carbonates range from 0 to 6 inches. In the control section, the soil is 35 to 75 percent gravel and chert and 5 to 15 percent calcium carbonate.

The A horizon has value of 4 or 5, dry, and 3 or 4, moist, and chroma of 2 or 3. It is dominantly gravelly sandy loam, but the range includes loam, sandy loam, and gravelly loam.

The Cca horizon has hue of 10YR or 2.5Y; value of 5 to 7, dry, and 4 to 6, moist; and chroma of 2 or 4.

Simeon series

The Simeon series consists of deep, excessively drained soils on stream terraces and uplands. Simeon soils formed in sandy alluvium that was reworked by the wind and mixed with eolian fine sand. Permeability is rapid. The slopes range from 0 to 17 percent.

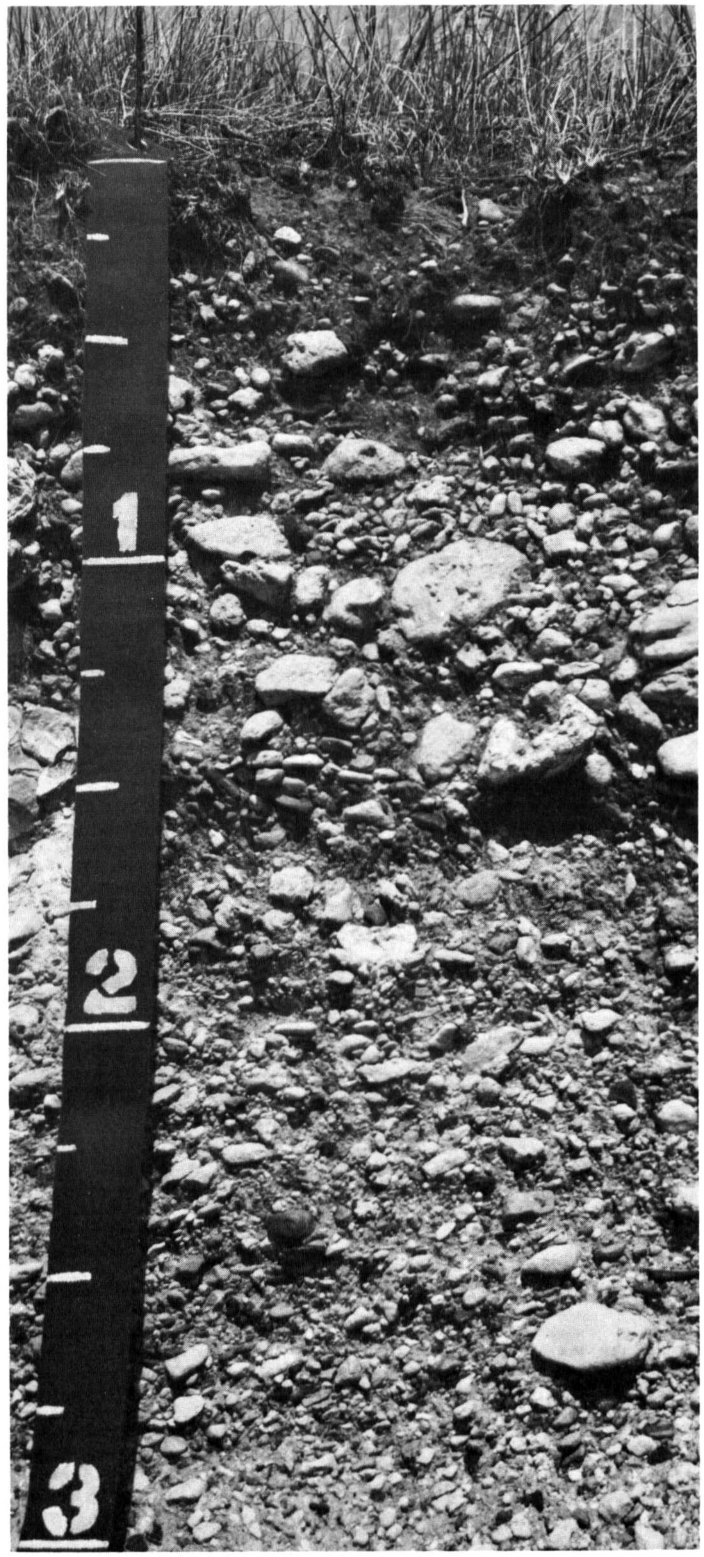


Figure 15.—Profile of Schamber gravelly sandy loam, 11 to 30 percent slopes. This soil formed mainly in a mixture of alluvial sand and gravel.

Simeon soils commonly are adjacent to Dunday, Ipage, O'Neill, and Valentine soils. Unlike Simeon soils, Dunday and O'Neill soils have a mollic epipedon. Ipage soils are well drained to moderately well drained. O'Neill soils have gravelly sand at a depth between 20 and 40 inches. Valentine soils consist mainly of fine sand; they are less than 35 percent medium sand and less than 10 percent coarse sand and very coarse sand. Dunday, Ipage, and O'Neill soils generally are in the same landscape positions as Simeon soils. Valentine soils generally are at a higher elevation than Simeon soils.

Typical pedon of Simeon loamy sand, in an area of Simeon-Valentine loamy sands, 0 to 3 percent slopes, 1,600 feet south and 200 feet west of the northeast corner sec. 4, T. 33 N., R. 22 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many very fine and fine roots; slightly acid; clear smooth boundary.

AC—5 to 18 inches; light brownish gray (10YR 6/2) loamy sand, brown (10YR 4/3) moist; weak coarse prismatic structure parting to single grained; slightly hard, very friable; common very fine and fine roots; neutral; clear smooth boundary.

C1—18 to 23 inches; very pale brown (10YR 7/3) gravelly coarse sand, pale brown (10YR 6/3) moist; single grained; soft, loose; few very fine roots; 15 percent fine gravel; neutral; gradual wavy boundary.

C2—23 to 60 inches; light gray (10YR 7/2) sand, light brownish gray (10YR 6/2) moist; single grained; loose; 2 percent gravel; mildly alkaline.

The solum is 7 to 20 inches thick.

The A horizon has value of 4 to 6, dry, and 3 to 5, moist, and chroma of 1 or 2. Textures include loamy sand, loamy fine sand, and fine sand.

The AC horizon has value of 5 to 7, dry, and 4 to 6, moist, and chroma of 1 to 3. It is loamy sand, loamy fine sand, sandy loam, fine sand, sand, or coarse sand.

The C horizon has value of 6 to 8, dry, and 5 to 7, moist, and chroma of 2 or 3. Textures include loamy coarse sand, sand, and coarse sand. The C horizon is as much as 15 percent gravel.

Tassel series

The Tassel series consists of shallow, well drained soils on uplands. Tassel soils formed in residuum of soft sandstone. Permeability is moderately rapid or rapid. The slopes range from 0 to 70 percent.

The Tassel soils in Keya Paha County are in a more humid climate than is typical for the Tassel series. This difference, however, does not affect the use or behavior of these soils.

Tassel soils commonly are adjacent to Duda, Holt, and Valentine soils. Unlike Tassel soils, Duda and Holt soils are 20 to 40 inches deep over weakly cemented sandstone. Holt soils have an argillic horizon. Valentine soils are deep, sandy soils on hummocks or dunes.

Typical pedon of Tassel loamy fine sand, 3 to 30 percent slopes, 50 feet west and 1,700 feet north of the southeast corner of sec. 10, T. 34 N., R. 21 W.

A11—0 to 5 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many fine and medium roots; mildly alkaline; gradual smooth boundary.

A12—5 to 9 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak fine granular; soft, very friable; common fine and medium roots; slight effervescence; moderately alkaline; gradual wavy boundary.

C—9 to 13 inches; light gray (2.5Y 7/2) loamy sand, grayish brown (2.5Y 5/2) moist; few very small white (10YR 8/2) fragments of soft sandstone; single grained; soft, very friable; few fine roots; slight effervescence; moderately alkaline; gradual broken boundary.

Cr—13 to 60 inches; white (2.5Y 8/2) soft sandstone, light grayish brown (2.5Y 6/2) moist; extremely hard, very firm; few fine roots in cracks; strong effervescence; moderately alkaline.

Bedrock is at a depth of 10 to 20 inches. The depth to free carbonates ranges from 0 to 8 inches. The soil is mildly alkaline or moderately alkaline throughout the profile.

The A horizon has value of 4 to 6, dry, and 3 to 5, moist, and chroma of 2 or 3. It is loamy fine sand or fine sandy loam.

The C horizon has value of 6 or 7, dry, and 4 or 5, moist, and chroma of 2 or 3. It is loamy fine sand or fine sandy loam.

Tuthill series

The Tuthill series consists of deep, well drained soils on uplands or foot slopes. Tuthill soils formed in loamy and sandy material of mixed origin. Permeability is moderate. The slopes are 0 to 2 percent.

The Tuthill soils in Keya Paha County are in a more humid climate than is typical for the Tuthill series, and they have a coarse-loamy control section. These differences do not affect the use or behavior of these soils.

Tuthill soils commonly are adjacent to Dunday, Holt, Jansen, Manter, and Wewela soils. Dunday soils are sandier than Tuthill soils and are on hummocks. Holt soils are coarser textured than Tuthill soils and have sandstone at a depth of less than 40 inches. Jansen soils have gravel at a depth of less than 40 inches. Manter soils are coarser textured and are in slightly

higher positions on the landscape than Tuthill soils. Wewela soils are moderatley deep over shale.

Typical pedon of Tuthill fine sandy loam, 0 to 2 percent slopes, 1,850 feet west and 50 feet north of the southwest corner of sec. 19, T. 34 N., R. 24 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; mildly alkaline; abrupt smooth boundary.

A12—7 to 11 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure parting to weak fine granular; hard, very friable; mildly alkaline; clear smooth boundary.

B1—11 to 18 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak moderate subangular blocky; hard, firm; mildly alkaline; clear smooth boundary.

B21t—18 to 24 inches; light brownish gray (10YR 6/2) sandy clay loam, grayish brown (10YR 4/3) moist; moderate coarse prismatic structure parting to moderate fine subangular blocky; very hard, firm; mildly alkaline; clear smooth boundary.

B3—24 to 27 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, firm; mildly alkaline; clear smooth boundary.

C—27 to 48 inches; light gray (2.5Y 7/2) loamy fine sand, light brownish gray (2.5Y 6/2) moist; single grained; soft, very friable; violent effervescence; moderately alkaline; clear wavy boundary.

Cr—48 to 60 inches; white (2.5Y 8/2) sandstone, light gray (5Y 7/2) moist; difficult to dig; moderately alkaline.

The solum is 21 to 36 inches thick. The mollic epipedon is 7 to 18 inches thick; in some places it includes the upper part of the subsoil. Free carbonates are at a depth of 36 to 46 inches.

The A horizon has value of 4 or 5, dry, and 2 or 3, moist, and chroma of 2. It is dominantly fine sandy loam, but the range includes loam.

The B horizon has value of 4 to 6, dry, and 3 to 5, moist, and chroma of 2 or 3. The Bt horizon is heavy fine sandy loam or sandy clay loam that is 18 to 25 percent clay.

The C horizon has value of 7 or 8, dry, and 5 to 7, moist, and chroma of 2 or 3. It generally is loamy fine sand, but the range includes loamy sand and fine sand.

The Cr horizon is at a depth of 40 to 60 inches. It is sandstone that ranges from very soft to hard.

Valentine series

The Valentine series consists of deep, excessively drained, sandy soils on uplands. Valentine soils formed in eolian sand. Permeability is rapid. The slopes range from 0 to 60 percent.

Valentine soils are similar to Inavale and Ipage soils. They commonly are adjacent to Duda, Dunday, Els, O'Neill, Simeon, and Wewela soils. Unlike Valentine soils, Ipage soils are moderately well drained, and Inavale soils are stratified and somewhat excessively drained. Duda soils are moderately deep over sandstone. Dunday, O'Neill, and Wewela soils have a mollic epipedon. O'Neill soils are coarse-loamy and are moderately deep over sand and gravel. Wewela soils have an argillic horizon and are moderately deep over shale. Els soils are somewhat poorly drained. Simeon soils are coarser textured in the control section than Valentine soils. All these soils have smoother slopes or are in lower positions on the landscape than Valentine soils.

Typical pedon of Valentine fine sand, rolling (fig. 16), 100 feet west and 50 feet north of the southeast corner of sec. 31, T. 34 N., R. 19 W.

A1—0 to 7 inches; dark grayish brown (10YR 5/2) fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many fine and medium roots; slightly acid; clear smooth boundary.

AC—7 to 16 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; single grained; loose; common very fine roots and few medium roots; neutral; gradual smooth boundary.

C—16 to 60 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose; few very fine roots; neutral.

The solum is 6 to 17 inches thick.

The A horizon has value of 4 or 5, dry, and 3 or 4, moist, and chroma of 2. It is dominantly fine sand, but the range includes loamy fine sand.

The AC horizon has value of 5 or 6, dry, and 4 or 5, moist, and chroma of 2 or 3. It is fine sand or loamy fine sand.

The C horizon has value of 6 or 7, dry, and 5 or 6, moist, and chroma of 2 to 4. It commonly has strata of fine textured material 1/8 inch to 2 inches thick. In places, it is underlain at a depth below 40 inches by sandstone, coarse sand, and siltstone.

Where the Valentine soils are associated with clayey soils, they have a clayey substratum at a depth of 40 to 60 inches and are mapped as a clayey substratum phase.

Verdel series

The Verdel series consists of deep, well drained soils on stream terraces and toe slopes on uplands. Verdel soils formed in clayey alluvium and in alluvium that derived from shale in the adjacent uplands. Permeability is slow. The slopes range from 0 to 6 percent.

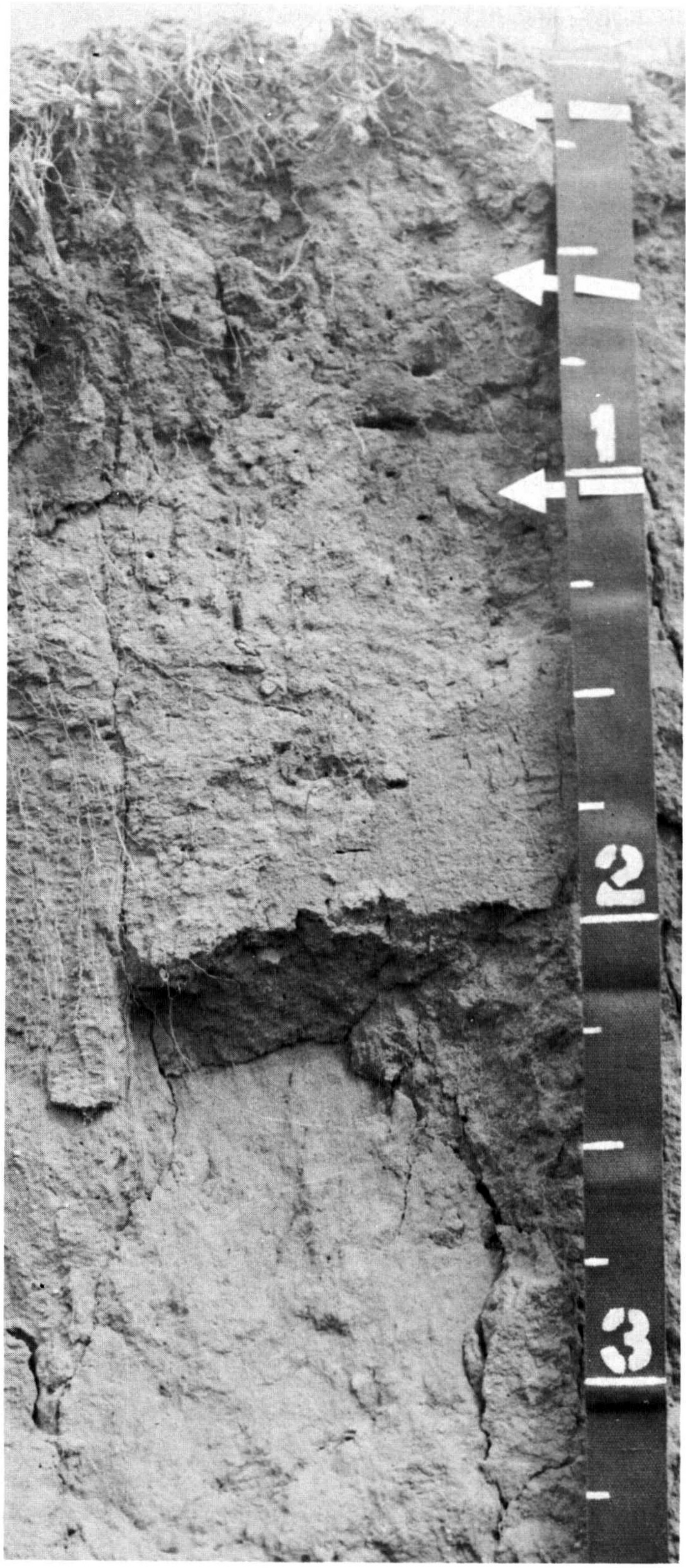


Figure 16.—Profile of Valentine fine sand, rolling. This soil formed in eolian sands.

Verdel soils commonly are adjacent to Cass, Labu, and Munjor soils. Unlike Verdel soils, Cass and Munjor soils are coarse-loamy; they are in slightly lower positions on the landscape. Labu soils have shale at a depth of 20 to 40 inches and do not have a mollic epipedon; they are at a higher elevation than Verdel soils.

Typical pedon of Verdel silty clay loam, 1 to 3 percent slopes, 1,300 feet north and 300 feet west of the center of sec. 36, T. 35 N., R. 19 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak coarse platy structure parting to weak medium granular; hard, firm; common fine roots; neutral; abrupt smooth boundary.

A12—7 to 18 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, firm; few very fine roots; mildly alkaline; gradual smooth boundary.

B21—18 to 26 inches; dark grayish brown (2.5Y 4/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; few very fine roots; slight effervescence; mildly alkaline; gradual smooth boundary.

B22—26 to 36 inches; dark grayish brown (2.5Y 4/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate coarse prismatic structure parting to moderate medium and fine subangular blocky; very hard, firm; few fine segregations of lime; strong effervescence; moderately alkaline; gradual smooth boundary.

C—36 to 60 inches; olive gray (5Y 5/2) clay, dark olive (5Y 4/3) moist; massive; extremely hard, very firm; few medium segregations of lime; strong effervescence; moderately alkaline.

The solum is 25 to 48 inches thick. The depth to carbonates ranges from 16 to 30 inches.

The A horizon has hue of 10YR or 2.5Y; value of 4 or 5, dry, and 2 or 3, moist; and chroma of 1 or 2. It is mainly silty clay loam, but the range includes silty clay.

The B horizon has hue of 2.5Y or 5Y; value of 4 to 6, dry, and 3 to 5, moist; and chroma of 2 or 3. Segregations of lime are common in the B horizon.

The C horizon has hue of 2.5Y or 5Y; value of 5 or 6, dry, and 4 or 5, moist; and chroma of 1 to 4. It ranges from silty clay to clay. Segregations of lime and gypsum are common in the C horizon.

Vetal series

The Vetal series consists of deep, well drained soils on stream terraces and uplands. Vetal soils formed in loamy material of old alluvial, colluvial, or eolian origin. Permeability is moderately rapid. The slopes range from 0 to 6 percent.

Vetal soils commonly are adjacent to Anselmo, Holt, and Jansen soils. Unlike Vetal soils, Anselmo, Holt, and Jansen soils have a mollic epipedon that is less than 20 inches thick. Holt soils have sandstone at a depth of 20 to 40 inches, and Jansen soils have sand and gravel at a depth of 20 to 40 inches; in addition, these soils have an argillic horizon. All these soils generally are at a higher elevation on the landscape than Vetal soils.

Typical pedon of Vetal loam, 0 to 1 percent slopes, 1,000 feet north and 700 feet west of the southeast corner of sec. 31, T. 33 N., R. 21 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, dark gray (10YR 3/1) moist; weak medium platy structure parting to weak fine granular; hard, friable; many very fine and fine roots; neutral; abrupt smooth boundary.

A12—6 to 18 inches; dark grayish brown (10YR 4/2) loam, dark gray (10YR 3/1) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable, many very fine and fine roots; neutral; clear smooth boundary.

B21—18 to 25 inches; dark grayish brown (10YR 4/2) loam, dark brown (10YR 3/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; common very fine and fine roots; neutral; gradual smooth boundary.

B22—25 to 34 inches; dark brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; few very fine and fine roots; neutral; gradual smooth boundary.

B23—34 to 47 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, friable; few very fine roots; moderately alkaline; clear smooth boundary.

C1—47 to 54 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; slightly hard, friable; violent effervescence; common segregations and threads of lime; moderately alkaline; clear wavy boundary.

IIC2—54 to 60 inches; very pale brown (10YR 7/4) loamy fine sand and fine sand, light yellowish brown (10YR 6/4) moist; single grained; slight effervescence; moderately alkaline.

The solum is 24 to 56 inches thick. The mollic epipedon is 20 to 48 inches thick.

The A horizon has value of 4 or 5, dry, and 3, moist, and chroma of 1 to 3. It is fine sandy loam, loam, or silt loam.

The B2 horizon has value of 4 to 6, dry, and 3 or 4, moist, and chroma of 1 to 3. It is loam, fine sandy loam, or silt loam.

The C horizon has value of 5 to 7, dry, and 4 to 6, moist, and chroma of 2 to 4. It is loam, very fine sandy loam, fine sandy loam, loamy fine sand, or fine sand.

Wewela series

The Wewela series consists of moderately deep, well drained soils on high stream terraces and uplands. Wewela soils formed in loamy material overlying clayey shale. Permeability is moderate in the upper part of these soils and very slow in the lower part. The slopes range from 0 to 9 percent.

Wewela soils commonly are adjacent to Anselmo, Ipage, Labu, Manter, Paka, and Valentine soils. Unlike Wewela soils, Anselmo and Manter soils are coarse-loamy. Anselmo, Ipage, Manter, and Valentine soils are deep. Ipage, Labu, and Valentine soils do not have a mollic epipedon. Labu soils are fine-textured and do not have loamy material in the upper part of the profile. Valentine soils generally are on hummocks or dunes at a higher elevation than Wewela soils.

Typical pedon of Wewela fine sandy loam, 0 to 3 percent slopes, 1,300 feet east and 1,300 feet south of the northwest corner of sec. 14, T. 34 N., R. 18 W.

Ap—0 to 4 inches; gray (10YR 5/1) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many very fine and fine roots; neutral; abrupt smooth boundary.

A12—4 to 8 inches; gray (10YR 5/1) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse blocky structure parting to weak fine granular; slightly hard, very friable; many very fine and medium roots; neutral; clear wavy boundary.

B2t—8 to 16 inches; grayish brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; common fine roots; coatings of dark material from the A horizon on faces of peds; slight effervescence at a depth of 12 inches; mildly alkaline; clear wavy boundary.

IIC—16 to 36 inches; light brownish gray (2.5Y 6/2) and light olive brown (5Y 5/4) clay, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure breaking to platy fragments; very hard, firm; few fine roots; common segregations of lime; violent effervescence; mildly alkaline; gradual wavy boundary.

IICr—36 to 60 inches; light brownish gray (2.5Y 6/2) and light olive brown (2.5Y 5/4) shale, grayish brown (2.5Y 5/2) moist; massive with platy fragments; hard, firm; many fine gypsum crystals; slight effervescence; moderately alkaline.

The solum is 14 to 23 inches thick. The mollic epipedon is 7 to 20 inches thick. Free carbonates are at a depth of 12 to 40 inches. Bedded shale is at a depth of 20 to 40 inches.

The A horizon has value of 4 or 5, dry, and 2 or 3, moist, and chroma of 1 or 2. It commonly is fine sandy loam, but the range includes loam and loamy fine sand.

The B2t horizon has hue of 10YR or 2.5Y; value of 5 or 6, dry, and 3 to 5, moist; and chroma of 2 to 4. It is clay loam, loam, or sandy clay loam.

The IIC horizon has hue of 2.5Y or 5Y; value of 5 or 6, dry, and 4 to 6, moist; and chroma of 2 to 6.

The IICr horizon has hue of 2.5Y or 5Y; value of 5 or 6, dry, and 4 or 5, moist; and chroma of 2 to 4.

formation of the soils

Soil is produced by soil-forming processes that act on the material that is deposited or accumulated by geologic forces. The characteristics of the soil at any given place are determined by (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, and (5) the length of time the processes of soil formation have acted on the soil material.

Climate and plants and animals, mainly plants, are the active factors in soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also influences soil formation and in extreme cases, entirely determines the kind of soil that is formed. Finally, time is needed for changing the parent material into soil and for the differentiation of soil horizons. In general, a long time is required for distinct horizons to develop.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil formation are unknown. In the following paragraphs, the factors of soil formation are briefly described as they relate to the soils in Keya Paha County.

parent material

Parent material is the unconsolidated mineral material in which a soil forms. It determines the chemical and mineralogical composition of the soil. The soils in Keya Paha County formed in material that weathered from underlying geologic formations or in material that was transported by wind and water.

The oldest geologic formation exposed in the county is the Pierre Formation, which is of Cretaceous age. Pierre Shale underlies all of Keya Paha County and outcrops along the terraces and side slopes of the Niobrara and Keya Paha River Valleys. This formation is subdivided into three members. Of these, only the two upper members are exposed in Keya Paha County—the Mobridge and Elk Butte members.

The Mobridge member of the Pierre Formation consists of beds of shaly chalk and calcareous shale. This material is medium to dark gray when first exposed and weathers to yellowish brown and yellowish orange. It is exposed in the deep canyons and cuts along the Niobrara and Keya Paha Rivers and their tributaries. It is not a parent material of any of the soils mapped in this survey. However, it does account for some of the clay material in the colluvial and alluvial soils on bottom lands.

The Elk Butte member of the Pierre Formation consists mainly of dark gray shale and claystone. It underlies the entire county. If exposed, this material weathers to an olive brown clay. The Labu and Sansarc soils formed in this weathered shale.

The next oldest geologic formation in Keya Paha County is the Rosebud or Chadron Formation of Miocene and Oligocene age. This Tertiary material consists mainly of siltstone beds. It outcrops throughout the northeastern and north-central parts of the county and along the north side of the Niobrara River Valley. Paka and Mariaville soils formed in material that weathered from this siltstone.

The most recent geologic formation in Keya Paha County is the Ogallala Formation, which is of Pliocene age. This Tertiary formation overlies the siltstone beds throughout much of the central and western parts of the county. It is subdivided into many members. The underlying members generally consist of sand, and the upper members consist of weathering cemented sandstone. Tassel, Ronson, Holt, Duda, and Manter soils formed in the weathered sandstone of the Ogallala Formation.

During the Quaternary period, unconsolidated material of clay, silt, sand, and gravel was deposited over much of the county in widely different topographic positons. This material, which was deposited by wind and water, overlies the Ogallala Formation in all but the western part of the county. In the areas near Springview and Jamison, a gravel sheet 20 to 60 feet thick mantles the Ogallala Formation. It is believed that this material was deposited during the Pleistocene age of the Quaternary period. These areas have since been mantled by a thin layer of loess. The Brocksburg, Jansen, Meadin, and O'Neill soils that are shallow and moderately deep over sand and gravel formed in this Quaternary material (*3*).

Wind-deposited silty material, or loess, mantles much of the uplands in the central and northwestern parts of the county. This loess generally is less than 10 feet thick. It consists of friable, massive, yellowish brown material that is calcareous and has a few concretions of lime. Onita and Reliance soils formed in this parent material.

The hummocks and dunes of sand in Keya Paha County are the result of the reworking of the Ogallala Formation by wind and water. They consist of loose, single grained, pale brown or very pale brown fine sandy loam, loamy fine sand, or fine sand. Anselmo, Vetal, Dunday, and Valentine soils formed in deep deposits of

this sandy material. The upper part of Paka fine sandy loam and Wewela fine sandy loam also formed in this eolian sand. In some areas, the Inavale and Vetal soils formed in eolian sand on stream terraces and bottom lands.

Colluvium is soil material that accumulates as a result of the combined forces of gravity and water. This parent material is on foot slopes at the base of hills of the clayey uplands. The gently sloping Labu soils and the upper part of Verdel soils formed in this clayey material.

Alluvium is the parent material of soils on bottom lands and stream terraces. It consists of sandy to clayey material that was deposited by streams. The bottom lands continue to receive sediment from flood waters. Barney, Boel, Cass, Munjor, and Inavale soils formed in alluvium on the bottom lands. The oldest alluvium is on the stream terraces above the present flood plain that are not subject to flooding. Vetal and Verdel soils formed in this old alluvium.

climate

The climate in Keya Paha County is subhumid and continental. Rainfall is light, winters are cold, summers are warm, winds are high, and there are frequent changes in weather conditions. Temperatures below 0 degrees F in winter and above 100 degrees F in summer are common. The mean annual temperature is 48.5 degrees F, and the average annual rainfall is 20.8 inches. The average growing season is about 144 days. Because the climate is fairly uniform throughout the county, it has not caused major differences among the soils.

Climate directly affects the rate of weathering and soil formation through rainfall, changes in temperature, and wind action. In Keya Paha County, precipitation is not heavy enough to leach the soils completely except in the sandy soils, for example, Valentine and Ipage soils. Leaching generally is limited to a depth of 2 to 3 feet in silty soils such as Onita and Reliance soils and to a depth of 12 inches in clayey soils such as Labu and Sansarc soils. As water moves through the soil, it carries nutrients, clay, and organic matter from the surface layer to the subsoil or other underlying layers.

The surface flow of water caused by heavy rains detaches, mixes, transports, and redeposits unconsolidated material of all kinds. The alluvial soils, including Cass, Inavale, and Munjor soils, formed in sediment that was deposited by water.

The amount of moisture and the prevailing temperature during the growing season affect the growth of vegetation, which is the principal source of organic matter. They also affect the chemical processes and the activities of microorganisms that convert organic matter to humus. Alternate freezing and thawing and wetting and drying speed the mechanical and chemical weathering processes and improve the physical condition of the soil.

Wind transfers soil material from one place to another. The extensive deposits of loess and sand in the county are the result of wind action. The gently rolling topography of Ree, Reliance, and Onita soils and the hummocky topography of Anselmo, Ipage, and Valentine soils are attributable to wind activity.

plants and animals

After parent material is deposited and once weathering slows down, bacteria, fungi, lichens, and other simple organisms invade the soil. After that, grasses and other plants take root. Once vegetation is established, many kinds of animals and organisms inhabit the soil and make use of the food provided by plants. Plants and animals help to develop the chemical and physical characteristics of a soil.

The soils in Keya Paha County formed mainly under mid and short grasses. Grasses have a fibrous root system that fills the surface layer with minute rootlets, which, upon decaying, contribute to the organic matter content and improve the porosity and structure of the soil. The deeper roots of prairie forbs improve the permeability of the subsoil and add a small amount of organic matter to the soils. Plant roots transport water from the deeper layers and thus add soluble minerals, including calcium, iron, phosphorus, and sulphur to the upper layers.

As plants decay, microorganisms act upon the undecomposed organic material to produce humus, which supplies nutrients to plants. Some bacteria absorb nitrogen from the air for their own growth. When these bacteria die, the nitrogen is added to the soil and is used by plants. Insects, earthworms, and small burrowing animals influence soil formation by mixing organic and mineral soil material. Their burrowing activities mix fresh nutrients into the soil and hasten the accumulation of organic matter.

The accumulation of organic matter has gradually darkened the surface layer of many of the soils in Keya Paha County. Vetal, Onita, and Verdel soils have a deep, dark surface layer. Ipage, Inavale, and Valentine soils have a thin dark surface layer.

Man also has altered the soils through the ways in which he has used and managed them.

relief

Relief, or the lay of the land, affects soil formation through its influence on runoff, drainage, and erosion. The degree of slope, shape of the surface, and permeability of the soil determine the rate of runoff, the internal drainage, and the moisture content of the soils. On the steeper slopes, more material is moved downslope through creep and erosion. Soils on ridges and hilltops are more exposed to air currents than are lower areas and thus lose more moisture through evaporation.

Steep soils have a thinner surface layer and less development in the subsoil than more gently sloping

soils. Because runoff is rapid on the steep slopes, only a small amount of water enters the soil. As a result, plant growth and soil formation are slow. If runoff is excessive, the surface layer can be eroded as fast as it forms. In soils on steep slopes lime is not leached very deep. In Keya Paha County, the Labu, Mariaville, and Sansarc soils have little profile development except for a thin slightly darkened surface layer.

Most of the nearly level to strongly sloping soils on uplands have some profile development. In general, as the slope of these soils increases, the thickness of their profile decreases. The low and flat topography results in more water being added to the soil. Because of this extra moisture, these upland soils have a thick, dark surface layer, more horizon development, and more leaching of lime. Onita soils are an example.

The soils on bottom lands and low stream terraces have little relief. Because the parent material of these soils has been in place for such a short time, relief has had little effect on soil formation. Some soils on bottom lands have a high water table, which affects soil temperatures and alkalinity and the rate of decay of organic material. Other soils on bottom lands are subject to flooding and continually receive deposits of sediment. In Keya Paha County, the Barney, Boel, and Loup soils on bottom lands are somewhat poorly drained or poorly drained.

time

Time is required for a soil to form from parent material. Young, or immature, soils are those in which the soil-forming factors have not affected the soil long enough for the soil to reach an equilibrium with its environment. Mature soils have reached an equilibrium with their environment. If land use, irrigation, or other factors change the environment, the soil, over a period of time, will establish an equilibrium with the new environment.

In soils that formed in residuum, the weathering of parent material and the formation of soil horizons in the weathered parent material generally occur simultaneously. In Keya Paha County, soils formed. Examples include the Labu, Paka, and Mariaville soils, which formed in residual shale or siltstone.

In transported, unconsolidated material including loess, sand, and alluvium, soil formation generally begins as soon as the material is stabilized on the landscape. In Keya Paha County, the soils that formed in unconsolidated loess have a thick profile and distinct horizons. The loess that was deposited throughout much of the northeastern part of the county has been in place long enough for the soils to develop a mature profile. Examples include the Onita, Ree, and Reliance soils, which have a dark, fairly thick surface layer, have lime leached to a depth of 2 to 3 feet, and have illuviated clay accumulated in their subsoil.

The parent material of most of the sandy soils has not been in place long enough for the soils to develop a mature profile. Examples are the Ipage, Simeon, and Valentine soils, which have little horizon development.

The alluvial soils are the youngest soils in the county. Because of the brief time their parent material has been in place, these soils have little or no subsoil development. Soils that are subject to flooding receive deposits of sediment with each flood.

The degree of development, or maturity, of a soil is evaluated on the basis of the soil characteristics rather than on the length of time the soil has been developing. The soil characteristics that commonly are indications of the maturity of a soil are thickness and color of the surface layer, degree of structure in the subsoil, evidence of the downward movement of clay in the soil, and the thickness of the solum.

references

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Skinner, M.F. and C.W. Hibbard. 1972. Early Pleistocene preglacial and glacial rocks and faunas of north-central Nebraska. Bull. of Amer. Mus. Nat. Hist. Vol. 148: Artic. 1. New York.

(4) United States Department of Agriculture. 1933. Soil survey of Keya Paha County, Nebraska. Series 1933, No. 10. 42 pp., maps.

(5) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173-188 issued May 1962]

(6) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Catsteps. Local, very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the

surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Depth, soil. In this soil survey, the classes of soil depth are (1) deep, more than 40 inches; (2) moderately deep, 20 to 40 inches; (3) shallow, 10 to 20 inches; and (4) very shallow, 0 to 10 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are

commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:
O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.
A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.
B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.
C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.
R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow

infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. In this survey, the

ratings for organic matter content are moderate, 2.0 to 4.0 percent; moderately low, 1.0 to 2.0 percent; low, 0.5 to 1.0 percent; and very low, less than 0.5 percent.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from

gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey, the classes of slopes are: nearly level, 0 to 2 percent; very gently sloping, 1 to 3 percent; gently sloping or undulating, 2 to 6 percent; strongly sloping or rolling, 6 to 11 percent; moderately steep, 11 to 17 percent; steep, 17 to 30 percent; and very steep, 30 percent or more.

Slow intake (in tables). The slow movement of water into the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited

geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-74 at Springview, Nebraska]

Month	Temperature: Average daily maximum	Temperature: Average daily minimum	Temperature: Average daily	Temperature: 2 years in 10 will have-- Maximum temperature higher than--	Temperature: 2 years in 10 will have-- Minimum temperature lower than--	Temperature: Average number of growing degree days[1]	Precipitation: Average	Precipitation: 2 years in 10 will have-- Less than--	Precipitation: 2 years in 10 will have-- More than--	Precipitation: Average number of days with 0.10 inch or more	Precipitation: Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	32.5	9.6	21.1	64	-21	11	.30	.05	.49	1	3.8
February---	37.5	14.5	26.0	68	-16	20	.59	.15	.94	2	7.0
March------	44.6	21.5	33.1	80	-7	104	.93	.30	1.42	3	7.9
April------	59.8	34.4	47.1	89	13	243	2.22	1.22	3.03	5	5.4
May--------	71.2	46.1	58.7	93	26	580	3.29	1.57	4.68	7	.2
June-------	81.3	56.3	68.8	103	40	864	3.66	2.06	4.95	7	.0
July-------	89.0	62.2	75.6	106	48	1,104	3.01	1.06	4.56	5	.0
August-----	87.7	60.6	74.2	104	46	1,060	2.00	1.02	2.80	4	.0
September--	76.8	49.9	63.4	100	29	702	1.90	.45	3.06	4	.0
October----	66.4	39.2	52.8	91	19	414	1.10	.41	1.69	3	1.8
November---	48.2	25.3	36.8	78	0	80	.73	.16	1.17	2	5.0
December---	36.3	14.9	25.6	65	-15	28	.52	.13	.81	2	6.3
Yearly:											
Average--	60.9	36.2	48.6	---	---	---	---	---	---	---	---
Extreme--	---	---	---	107	-22	---	---	---	---	---	---
Total----	---	---	---	---	---	5,210	20.25	16.11	23.57	45	37.4

[1]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-1974 at Springview, Nebraska]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 1	May 7	May 20
2 years in 10 later than--	April 26	May 3	May 15
5 years in 10 later than--	April 16	April 24	May 4
First freezing temperature in fall:			
1 year in 10 earlier than--	October 9	October 2	September 19
2 years in 10 earlier than--	October 15	October 7	September 24
5 years in 10 earlier than--	October 25	October 17	October 5

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-74 at Springview, Nebraska]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	171	158	128
8 years in 10	178	164	137
5 years in 10	191	175	153
2 years in 10	205	187	169
1 year in 10	212	193	177

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ab	Albaton Variant clay, 0 to 2 percent slopes	260	0.1
AmB	Anselmo loamy fine sand, 0 to 3 percent slopes	2,920	0.6
An	Anselmo fine sandy loam, 0 to 2 percent slopes	2,720	0.6
AnC	Anselmo fine sandy loam, 2 to 6 percent slopes	3,120	0.6
Ba	Barney fine sandy loam, 0 to 2 percent slopes	970	0.2
Bo	Boel fine sandy loam, 0 to 2 percent slopes	490	0.1
Bt	Brocksburg loam, 0 to 1 percent slopes	4,620	0.9
Cb	Cass loam, 0 to 2 percent slopes	1,480	0.3
CcB	Cass loam, channeled, 0 to 3 percent slopes	610	0.1
DdB	Duda loamy fine sand, 0 to 3 percent slopes	2,720	0.6
DdC	Duda loamy fine sand, 3 to 6 percent slopes	4,420	0.9
DuB	Dunday loamy fine sand, 0 to 3 percent slopes	7,550	1.5
DxB	Dunday-Duda loamy fine sands, 0 to 3 percent slopes	5,200	1.0
Eo	Els fine sand, 0 to 2 percent slopes	11,420	2.3
Es	Elsmere loamy fine sand, 0 to 2 percent slopes	8,440	1.7
Ho	Holt fine sandy loam, 0 to 2 percent slopes	4,550	0.9
HoC	Holt fine sandy loam, 2 to 6 percent slopes	1,410	0.3
HtC	Holt-Tassel fine sandy loams, 3 to 6 percent slopes	1,320	0.3
HtD	Holt-Tassel fine sandy loams, 6 to 11 percent slopes	1,370	0.3
IfD	Inavale fine sand, 3 to 11 percent slopes	530	0.1
IgB	Inavale fine sand, channeled, 0 to 3 percent slopes	3,850	0.8
IhB	Inavale loamy fine sand, 0 to 3 percent slopes	6,190	1.2
IpB	Ipage loamy fine sand, 0 to 3 percent slopes	22,570	4.6
Ja	Jansen fine sandy loam, 0 to 2 percent slopes	2,870	0.6
Jn	Jansen loam, 0 to 2 percent slopes	1,520	0.3
JnC	Jansen loam, 2 to 6 percent slopes	3,370	0.7
JoB	Jansen-Meadin loams, 0 to 3 percent slopes	11,470	2.3
LaD	Labu silty clay, 6 to 11 percent slopes	3,200	0.6
LcF	Labu-Sansarc silty clays, 11 to 30 percent slopes	11,870	2.4
Lo	Loup fine sandy loam, 0 to 2 percent slopes	11,350	2.3
Lp	Loup fine sandy loam, wet, 0 to 2 percent slopes	1,970	0.4
MaB	Manter loamy fine sand, 0 to 3 percent slopes	8,230	1.7
MaC	Manter loamy fine sand, 3 to 6 percent slopes	3,620	0.7
MfC	Manter fine sandy loam, 2 to 6 percent slopes	4,770	1.0
MkG	Mariaville-Keota silt loams, 15 to 60 percent slopes	2,580	0.5
Mm	Marlake loamy fine sand, 0 to 1 percent slopes	340	0.1
MnF	Meadin gravelly sandy loam, 3 to 30 percent slopes	9,030	1.8
Mu	Munjor fine sandy loam, 0 to 2 percent slopes	1,710	0.4
OaB	O'Neill loamy fine sand, 0 to 3 percent slopes	4,670	0.9
Oe	O'Neill fine sandy loam, 0 to 2 percent slopes	3,980	0.8
OeC	O'Neill fine sandy loam, 2 to 6 percent slopes	820	0.2
OeD	O'Neill fine sandy loam, 6 to 9 percent slopes	610	0.1
OhB	O'Neill-Meadin fine sandy loams, 0 to 3 percent slopes	7,160	1.4
OkD	O'Neill-Valentine complex, 1 to 9 percent slopes	1,730	0.4
On	Onita silt loam, 0 to 1 percent slopes	810	0.2
Or	Ord-Loup fine sandy loams, 0 to 2 percent slopes	10,570	2.1
Pf	Paka fine sandy loam, 0 to 2 percent slopes	970	0.2
Ph	Paka loam, 0 to 1 percent slopes	450	0.1
PhB	Paka loam, 1 to 3 percent slopes	1,380	0.3
PmC	Paka-Mariaville loams, 3 to 6 percent slopes	1,680	0.3
PmF	Paka-Mariaville loams, 11 to 30 percent slopes	2,770	0.6
RaB	Ree loam, 1 to 3 percent slopes	1,200	0.2
Rb	Ree loam, clayey substratum, 0 to 2 percent slopes	540	0.1
ReC	Reliance silt loam, 2 to 6 percent slopes	1,220	0.2
RoD	Ronson-Anselmo fine sandy loams, 6 to 9 percent slopes	3,570	0.7
RoF	Ronson-Anselmo fine sandy loams, 9 to 30 percent slopes	6,870	1.4
RtB	Ronson-Tassel fine sandy loams, 0 to 3 percent slopes	20,350	4.1
SaG	Sansarc silty clay, 20 to 40 percent slopes	6,020	1.2
ScF	Schamber gravelly sandy loam, 11 to 30 percent slopes	790	0.2
SmF	Simeon-Manter-Ronson complex, 6 to 17 percent slopes	29,840	6.0
SvF2	Simeon-Valentine fine sands, 6 to 17 percent slopes, eroded	2,020	0.4
SwB	Simeon-Valentine loamy sands, 0 to 3 percent slopes	5,120	1.0
TaF	Tassel loamy fine sand, 3 to 30 percent slopes	3,460	0.7
TdE	Tassel-Duda complex, 3 to 15 percent slopes	14,590	2.9
TrG	Tassel-Ronson-Duda complex, 15 to 70 percent slopes	39,830	8.0
Tu	Tuthill fine sandy loam, 0 to 2 percent slopes	4,440	0.9
VaF	Valentine fine sand, rolling	71,120	14.4
VaG	Valentine fine sand, hilly	2,220	0.4
VbD	Valentine loamy fine sand, gently rolling	20,650	4.2
VcF	Valentine-Tassel complex, rolling	20,090	4.1
VdC	Valentine-Wewela loamy fine sands, 3 to 6 percent slopes	2,190	0.4
VdF	Valentine-Wewela loamy fine sands, 6 to 30 percent slopes	5,330	1.1

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
Ve	Verdel silty clay loam, 0 to 1 percent slopes	680	0.1
VeB	Verdel silty clay loam, 1 to 3 percent slopes	730	0.1
VeC	Verdel silty clay loam, 3 to 6 percent slopes	1,220	0.2
Vo	Vetal fine sandy loam, 0 to 2 percent slopes	3,060	0.6
Vt	Vetal loam, 0 to 1 percent slopes	3,550	0.7
VtB	Vetal loam, 1 to 3 percent slopes	1,270	0.3
VtC	Vetal loam, 3 to 6 percent slopes	490	0.1
WeB	Wewela fine sandy loam, 0 to 3 percent slopes	2,340	0.5
WeC	Wewela fine sandy loam, 3 to 6 percent slopes	2,270	0.5
	Water areas more than 40 acres in size	3,780	0.8
	Water areas less than 40 acres in size	280	0.1
	Total	495,360	100.0

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn		Alfalfa hay		Winter wheat	
	N	I	N	I	N	I
	Bu	Bu	Ton	Ton	Bu	Bu
Ab-------------------------- Albaton Variant	35	---	2.5	---	25	---
AmB------------------------- Anselmo	28	115	1.5	4.0	15	---
An-------------------------- Anselmo	38	135	2.0	5.0	20	---
AnC------------------------- Anselmo	35	130	1.9	4.9	18	---
Ba-------------------------- Barney	---	---	---	---	---	---
Bo-------------------------- Boel	35	100	3.0	4.5	19	---
Bt-------------------------- Brocksburg	34	135	2.0	5.2	25	---
Cb-------------------------- Cass	40	133	1.3	5.3	22	---
CcB------------------------- Cass	---	---	---	---	---	---
DdB------------------------- Duda	20	118	1.5	4.0	15	---
DdC------------------------- Duda	18	---	1.5	3.8	13	---
DuB------------------------- Dunday	25	122	1.6	4.0	15	---
DxB------------------------- Dunday-Duda	25	120	1.6	4.0	15	---
Eo-------------------------- Els	---	85	---	3.5	---	---
Es-------------------------- Elsmere	35	100	2.0	4.0	20	---
Ho-------------------------- Holt	30	125	2.0	4.8	20	---
HoC------------------------- Holt	27	120	1.7	4.5	18	---
HtC------------------------- Holt-Tassel	25	110	1.5	4.0	16	---
HtD------------------------- Holt-Tassel	23	100	1.5	4.0	15	---
IfD------------------------- Inavale	---	80	---	2.5	---	---
IgB------------------------- Inavale	---	---	---	---	---	---
IhB------------------------- Inavale	25	110	1.5	4.0	15	---

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn		Alfalfa hay		Winter wheat	
	N	I	N	I	N	I
	Bu	Bu	Ton	Ton	Bu	Bu
IpB: Ipage	20	110	1.0	4.0	10	---
Ja: Jansen	26	130	1.8	4.5	18	---
Jn: Jansen	30	135	1.5	5.0	21	---
JnC: Jansen	25	128	1.3	4.4	20	---
JoB: Jansen-Meadin	15	100	1.0	4.2	15	---
LaD: Labu	20	---	0.9	---	23	---
LcF: Labu-Sansarc	---	---	---	---	---	---
Lo, Lp: Loup	---	---	---	---	---	---
MaB: Manter	25	125	1.5	4.3	15	---
MaC: Manter	22	120	1.4	4.2	14	---
MfC: Manter	27	130	1.7	4.5	19	---
MkG: Mariaville-Keota	---	---	---	---	---	---
Mm: Marlake	---	---	---	---	---	---
MnF: Meadin	---	---	---	---	---	---
Mu: Munjor	35	130	2.2	5.2	20	---
OaB: O'Neill	20	105	1.2	4.0	13	---
Oe: O'Neill	25	125	0.9	3.8	16	---
OeC: O'Neill	22	110	0.8	3.5	15	---
OeD: O'Neill	18	---	0.7	3.3	12	---
OhB: O'Neill-Meadin	---	95	---	2.5	---	---
OkD: O'Neill-Valentine	---	95	---	2.5	---	---
On: Onita	50	140	1.6	5.5	30	---
Or: Ord-Loup	40	110	2.0	5.0	20	---
Pf: Paka	38	130	1.9	4.5	19	---

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn		Alfalfa hay		Winter wheat	
	N	I	N	I	N	I
	Bu	Bu	Ton	Ton	Bu	Bu
Ph: Paka	47	140	1.9	5.2	27	---
PhB: Paka	42	130	1.7	4.5	25	---
PmC: Paka-Mariaville	30	115	1.5	4.3	23	---
PmF: Paka-Mariaville	---	---	---	---	---	---
RaB: Ree	40	135	1.3	4.5	27	---
Rb: Ree	35	130	2.1	5.0	25	---
ReC: Reliance	45	130	1.3	5.0	25	---
RoD: Ronson-Anselmo	23	120	1.0	4.0	16	---
RoF: Ronson-Anselmo	---	---	---	---	---	---
RtB: Ronson-Tassel	18	90	1.5	4.0	15	---
SaG: Sansarc	---	---	---	---	---	---
ScF: Schamber	---	---	---	---	---	---
SmF: Simeon-Manter-Ronson	---	---	---	---	---	---
SvF2: Simeon-Valentine	---	---	---	---	---	---
SwB: Simeon-Valentine	---	90	---	2.8	---	---
TaF: Tassel	---	---	---	---	---	---
TdE: Tassel-Duda	---	---	---	---	---	---
TrG: Tassel-Ronson-Duda	---	---	---	---	---	---
Tu: Tuthill	30	135	2.0	5.0	20	---
VaF: Valentine	---	---	---	---	---	---
VaG: Valentine	---	---	---	---	---	---
VbD: Valentine	---	95	---	3.0	---	---
VcF: Valentine-Tassel	---	---	---	---	---	---

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn		Alfalfa hay		Winter wheat	
	N	I	N	I	N	I
	Bu	Bu	Ton	Ton	Bu	Bu
VdC------------------------ Valentine-Wewela	25	110	1.0	4.0	15	---
VdF------------------------ Valentine-Wewela	---	---	---	---	---	---
Ve------------------------- Verdel	40	115	1.4	5.0	25	---
VeB------------------------ Verdel	35	110	1.4	4.9	24	---
VeC------------------------ Verdel	30	---	1.3	---	22	---
Vo------------------------- Vetal	40	135	1.8	5.2	20	---
Vt------------------------- Vetal	45	140	2.7	6.0	30	---
VtB------------------------ Vetal	40	135	2.5	5.8	28	---
VtC------------------------ Vetal	38	130	1.7	5.0	25	---
WeB------------------------ Wewela	30	125	1.2	4.2	20	---
WeC------------------------ Wewela	27	120	1.0	4.0	18	---

TABLE 6 --CAPABILITY CLASSES AND SUBCLASSES

[All soils are assigned to nonirrigated capability subclasses (N). Only those potentially irrigable soils are assigned to irrigated subclasses (I). Miscellaneous areas are excluded. Dashes indicate no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I (N)	1,480	---	---	---
(I)	6,290	---	---	---
II (N)	29,650	18,020	6,820	4,810
(I)	27,710	20,890	---	6,820
III (N)	53,230	42,170	11,060	---
(I)	72,140	61,080	11,060	---
IV (N)	112,750	92,580	8,700	11,470
(I)	159,650	122,940	20,120	16,590
V (N)	14,290	---	14,290	---
VI (N)	228,910	178,020	15,880	35,010
VII (N)	50,650	2,220	48,430	---
VIII(N)	340	---	340	---

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Ab: Albaton Variant	Clayey Overflow	Favorable	4,000	Big bluestem	20
		Normal	3,250	Western wheatgrass	20
		Unfavorable	1,750	Green needlegrass	15
				Little bluestem	10
				Switchgrass	10
				Indiangrass	5
				Blue grama	5
				Sedge	5
AmB, An, AnC: Anselmo	Sandy	Favorable	3,250	Little bluestem	23
		Normal	2,600	Blue grama	18
		Unfavorable	1,350	Sand bluestem	13
				Needleandthread	12
				Prairie sandreed	8
				Buffalograss	5
				Western wheatgrass	5
Ba: Barney	Wetland	Favorable	5,500	Prairie cordgrass	30
		Normal	5,000	Northern reedgrass	10
		Unfavorable	3,500	Sedge	10
				Rush	10
				Kentucky bluegrass	10
				Bluejoint reedgrass	5
				Switchgrass	5
				Common spikesedge	5
Bo: Boel	Subirrigated	Favorable	5,000	Big bluestem	25
		Normal	4,500	Indiangrass	15
		Unfavorable	3,750	Switchgrass	15
				Little bluestem	10
				Prairie cordgrass	10
				Sedge	7
Bt: Brocksburg	Silty	Favorable	3,250	Big bluestem	35
		Normal	2,500	Little bluestem	18
		Unfavorable	1,750	Sideoats grama	10
				Indiangrass	6
				Blue grama	6
				Switchgrass	5
Cb, CcB: Cass	Sandy Lowland	Favorable	4,000	Sand bluestem	30
		Normal	3,500	Little bluestem	15
		Unfavorable	2,500	Indiangrass	10
				Switchgrass	10
				Porcupinegrass	10
				Sedge	5
DdB, DdC: Duda	Sandy	Favorable	3,000	Sand bluestem	30
		Normal	2,500	Prairie sandreed	20
		Unfavorable	1,750	Little bluestem	15
				Needleandthread	10
				Switchgrass	5
				Sand dropseed	5
				Blue grama	5
				Sedge	5
DuB: Dunday	Sandy	Favorable	3,000	Sand bluestem	25
		Normal	2,500	Little bluestem	20
		Unfavorable	1,750	Prairie sandreed	19
				Needleandthread	10
				Blue grama	7
				Switchgrass	5
				Sedge	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
DxB*:					
Dunday	Sandy	Favorable	3,000	Sand bluestem	25
		Normal	2,500	Little bluestem	20
		Unfavorable	1,750	Prairie sandreed	19
				Needleandthread	10
				Blue grama	7
				Switchgrass	5
				Sedge	5
Duda	Sandy	Favorable	3,000	Sand bluestem	30
		Normal	2,500	Prairie sandreed	20
		Unfavorable	1,750	Little bluestem	15
				Needleandthread	10
				Switchgrass	5
				Sand dropseed	5
				Blue grama	5
				Sedge	5
Eo Els	Subirrigated	Favorable	5,000	Big bluestem	30
		Normal	4,000	Indiangrass	15
		Unfavorable	3,000	Prairie cordgrass	15
				Switchgrass	10
				Little bluestem	7
				Sedge	7
				Kentucky bluegrass	5
Es Elsmere	Subirrigated	Favorable	5,500	Big bluestem	30
		Normal	4,800	Indiangrass	15
		Unfavorable	3,500	Prairie cordgrass	15
				Switchgrass	10
				Little bluestem	7
				Sedge	7
				Kentucky bluegrass	5
Ho, HoC Holt	Sandy	Favorable	3,120	Little bluestem	30
		Normal	2,600	Prairie sandreed	15
		Unfavorable	1,820	Sand bluestem	15
				Needleandthread	10
				Blue grama	10
				Porcupinegrass	5
				Leadplant	5
				Sedge	5
HtC*, HtD*:					
Holt	Sandy	Favorable	3,000	Little bluestem	30
		Normal	2,500	Prairie sandreed	15
		Unfavorable	1,750	Sand bluestem	15
				Needleandthread	10
				Blue grama	10
				Porcupinegrass	5
				Leadplant	5
				Sedge	5
Tassel	Shallow Limy	Favorable	2,500	Needleandthread	30
		Normal	2,250	Threadleaf sedge	20
		Unfavorable	1,750	Blue grama	16
				Sand bluestem	5
				Little bluestem	5
				Broom snakeweed	5
IfD Inavale	Sands	Favorable	2,750	Sand bluestem	20
		Normal	2,250	Little bluestem	25
		Unfavorable	1,500	Prairie sandreed	15
				Needleandthread	15
				Switchgrass	5
				Blue grama	5
				Sand dropseed	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
IgB: Inavale	Sandy Lowland	Favorable	4,000	Sand bluestem	45
		Normal	3,250	Porcupinegrass	15
		Unfavorable	2,500	Little bluestem	10
				Prairie sandreed	10
				Switchgrass	5
				Sedge	5
				Needleandthread	5
IhB: Inavale	Sandy Lowland	Favorable	3,750	Sand bluestem	30
		Normal	3,000	Prairie sandreed	20
		Unfavorable	2,250	Little bluestem	15
				Needleandthread	15
				Switchgrass	5
				Porcupinegrass	5
				Sedge	5
IpB: Ipage	Sandy Lowland	Favorable	4,000	Sand bluestem	15
		Normal	3,500	Prairie sandreed	15
		Unfavorable	2,500	Little bluestem	10
				Needleandthread	10
				Sedge	7
				Kentucky bluegrass	5
				Indiangrass	5
				Prairie junegrass	5
				Switchgrass	5
				Scribner panicum	5
				Leadplant	5
Ja: Jansen	Sandy	Favorable	3,250	Little bluestem	25
		Normal	2,500	Sand bluestem	15
		Unfavorable	1,500	Blue grama	10
				Sand dropseed	10
				Needleandthread	10
				Prairie sandreed	10
				Sedge	5
				Purple lovegrass	5
				Western wheatgrass	5
Jn, JnC: Jansen	Silty	Favorable	3,500	Little bluestem	25
		Normal	2,500	Big bluestem	20
		Unfavorable	1,500	Sideoats grama	15
				Blue grama	10
				Buffalograss	5
				Sand dropseed	5
				Western wheatgrass	5
JoB*:					
Jansen	Silty	Favorable	3,500	Little bluestem	25
		Normal	2,500	Big bluestem	20
		Unfavorable	1,500	Sideoats grama	15
				Blue grama	10
				Buffalograss	5
				Sand dropseed	5
				Western wheatgrass	5
Meadin	Shallow To Gravel	Favorable	2,500	Blue grama	20
		Normal	2,000	Prairie sandreed	10
		Unfavorable	1,000	Sand bluestem	10
				Sand dropseed	10
				Clubmoss	10
				Needleandthread	8
				Sedge	6
				Little bluestem	5
				Switchgrass	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
LaD: Labu	Clayey	Favorable	2,600	Big bluestem	25
		Normal	2,300	Little bluestem	15
		Unfavorable	1,600	Green needlegrass	15
				Sideoats grama	10
				Western wheatgrass	10
				Blue grama	5
				Kentucky bluegrass	5
				Sedge	5
LcF*:					
Labu	Clayey	Favorable	2,600	Big bluestem	25
		Normal	2,300	Little bluestem	15
		Unfavorable	1,600	Green needlegrass	15
				Sideoats grama	10
				Western wheatgrass	10
				Blue grama	5
				Kentucky bluegrass	5
				Sedge	5
Sansarc	Shallow Clay	Favorable	2,250	Little bluestem	35
		Normal	2,000	Sideoats grama	20
		Unfavorable	1,500	Blue grama	15
				Needleandthread	10
				Green needlegrass	5
				Sedge	5
Lo: Loup	Wet Subirrigated	Favorable	6,250	Switchgrass	30
		Normal	5,500	Indiangrass	15
		Unfavorable	4,250	Prairie cordgrass	15
				Big bluestem	10
				Plains bluegrass	5
				Sedge	5
				Canada wildrye	5
Lp: Loup	Wetland	Favorable	6,500	Prairie cordgrass	75
		Normal	6,000	Bulrush	10
		Unfavorable	5,500	Sedge	10
				Rush	5
MaB, MaC, MfC: Manter	Sandy	Favorable	3,250	Prairie sandreed	20
		Normal	2,500	Sand bluestem	15
		Unfavorable	1,500	Little bluestem	15
				Needleandthread	15
				Blue grama	10
				Switchgrass	5
				Sedge	5
MkG*:					
Mariaville	Shallow Limy	Favorable	2,750	Little bluestem	20
		Normal	2,250	Big bluestem	15
		Unfavorable	1,500	Sideoats grama	10
				Threadleaf sedge	10
				Needleandthread	10
				Blue grama	5
				Plains muhly	5
				Leadplant	5
				Fringed sagebrush	5
Keota	Limy Upland	Favorable	3,000	Blue grama	50
		Normal	2,250	Winterfat	15
		Unfavorable	1,250	Western wheatgrass	8
				Alkali sacaton	7
				Sideoats grama	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
MnF----------------Meadin	Shallow To Gravel-------------	Favorable	2,500	Blue grama--------------------	20
		Normal	2,000	Prairie sandreed--------------	10
		Unfavorable	1,000	Sand bluestem-----------------	10
				Sand dropseed-----------------	10
				Clubmoss----------------------	10
				Needleandthread---------------	10
				Switchgrass-------------------	5
				Sedge-------------------------	5
				Little bluestem---------------	5
Mu-----------------Munjor	Sandy Lowland-----------------	Favorable	4,000	Sand bluestem-----------------	30
		Normal	3,500	Little bluestem---------------	15
		Unfavorable	2,500	Prairie sandreed--------------	10
				Needleandthread---------------	10
				Switchgrass-------------------	10
				Blue grama--------------------	5
				Sedge-------------------------	5
				Indiangrass-------------------	5
OaB, Oe, OeC, OeD--O'Neill	Sandy-------------------------	Favorable	2,750	Sand bluestem-----------------	20
		Normal	2,000	Little bluestem---------------	15
		Unfavorable	1,250	Prairie sandreed--------------	15
				Blue grama--------------------	10
				Needleandthread---------------	10
				Switchgrass-------------------	7
				Sand dropseed-----------------	5
				Gray sagewort-----------------	5
OhB*:					
O'Neill-----------	Sandy-------------------------	Favorable	2,750	Sand bluestem-----------------	20
		Normal	2,000	Little bluestem---------------	15
		Unfavorable	1,250	Prairie sandreed--------------	15
				Blue grama--------------------	10
				Needleandthread---------------	10
				Switchgrass-------------------	7
				Sand dropseed-----------------	5
				Gray sagewort-----------------	5
Meadin------------	Shallow To Gravel-------------	Favorable	2,500	Blue grama--------------------	20
		Normal	2,000	Prairie sandreed--------------	10
		Unfavorable	1,000	Sand bluestem-----------------	10
				Sand dropseed-----------------	10
				Clubmoss----------------------	10
				Needleandthread---------------	10
				Sedge-------------------------	5
				Little bluestem---------------	5
				Switchgrass-------------------	5
OkD*:					
O'Neill-----------	Sandy-------------------------	Favorable	2,750	Sand bluestem-----------------	20
		Normal	2,000	Little bluestem---------------	15
		Unfavorable	1,250	Prairie sandreed--------------	15
				Blue grama--------------------	10
				Needleandthread---------------	10
				Switchgrass-------------------	7
				Sand dropseed-----------------	5
				Gray sagewort-----------------	5
Valentine---------	Sands-------------------------	Favorable	3,000	Prairie sandreed--------------	20
		Normal	2,400	Sand bluestem-----------------	18
		Unfavorable	1,800	Little bluestem---------------	15
				Sand lovegrass----------------	10
				Switchgrass-------------------	8
				Needleandthread---------------	8
				Blue grama--------------------	5
				Sand dropseed-----------------	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
On: Onita	Silty	Favorable	3,500	Big bluestem	25
		Normal	2,750	Little bluestem	20
		Unfavorable	1,750	Sideoats grama	15
				Blue grama	10
				Buffalograss	5
				Switchgrass	5
				Indiangrass	5
				Western wheatgrass	5
Or*: Ord	Subirrigated	Favorable	6,000	Big bluestem	30
		Normal	5,500	Indiangrass	12
		Unfavorable	5,000	Little bluestem	10
				Switchgrass	10
				Prairie cordgrass	10
				Sedge	5
Loup	Wet Subirrigated	Favorable	6,250	Switchgrass	30
		Normal	5,500	Indiangrass	15
		Unfavorable	4,250	Prairie cordgrass	15
				Big bluestem	10
				Plains bluegrass	5
				Sedge	5
				Canada wildrye	5
Pf: Paka	Sandy	Favorable	3,250	Little bluestem	25
		Normal	2,500	Needleandthread	20
		Unfavorable	1,500	Sand bluestem	15
				Blue grama	10
				Switchgrass	5
				Indiangrass	5
				Western wheatgrass	5
				Sedge	5
Ph, PhB: Paka	Silty	Favorable	3,500	Little bluestem	25
		Normal	3,000	Big bluestem	20
		Unfavorable	2,000	Sideoats grama	10
				Needleandthread	10
				Switchgrass	5
				Indiangrass	5
				Blue grama	5
				Western wheatgrass	5
				Sedge	5
PmC*, PmF*: Paka	Silty	Favorable	3,500	Little bluestem	25
		Normal	3,000	Big bluestem	20
		Unfavorable	2,000	Sideoats grama	10
				Needleandthread	10
				Switchgrass	5
				Indiangrass	5
				Blue grama	5
				Western wheatgrass	5
				Sedge	5
Mariaville	Shallow Limy	Favorable	2,750	Little bluestem	20
		Normal	2,250	Big bluestem	15
		Unfavorable	1,500	Sideoats grama	10
				Threadleaf sedge	10
				Needleandthread	10
				Blue grama	5
				Plains muhly	5
				Leadplant	5
				Fringed sagebrush	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
RaB: Ree	Silty	Favorable	3,250	Little bluestem	20
		Normal	2,500	Big bluestem	10
		Unfavorable	1,500	Western wheatgrass	10
				Green needlegrass	10
				Needleandthread	10
				Sideoats grama	10
				Blue grama	5
Rb: Ree	Silty	Favorable	3,500	Little bluestem	15
		Normal	2,750	Big bluestem	15
		Unfavorable	1,750	Green needlegrass	15
				Sideoats grama	10
				Western wheatgrass	10
				Needleandthread	10
				Blue grama	5
ReC: Reliance	Silty	Favorable	3,500	Big bluestem	20
		Normal	2,750	Little bluestem	15
		Unfavorable	1,750	Western wheatgrass	15
				Sideoats grama	10
				Green needlegrass	10
				Blue grama	5
				Needleandthread	5
RoD*, RoF*:					
Ronson	Sandy	Favorable	3,000	Sand bluestem	20
		Normal	2,750	Little bluestem	15
		Unfavorable	1,750	Prairie sandreed	15
				Needleandthread	15
				Blue grama	10
				Switchgrass	5
				Sedge	5
Anselmo	Sandy	Favorable	3,250	Little bluestem	23
		Normal	2,600	Blue grama	18
		Unfavorable	1,350	Sand bluestem	13
				Needleandthread	12
				Prairie sandreed	8
				Buffalograss	5
				Western wheatgrass	5
RtB*:					
Ronson	Sandy	Favorable	3,000	Sand bluestem	20
		Normal	2,500	Little bluestem	15
		Unfavorable	1,750	Prairie sandreed	15
				Needleandthread	15
				Blue grama	10
				Switchgrass	5
				Sedge	5
Tassel	Shallow Limy	Favorable	2,500	Needleandthread	30
		Normal	2,250	Threadleaf sedge	20
		Unfavorable	1,750	Blue grama	16
				Sand bluestem	5
				Little bluestem	5
				Broom snakeweed	5
SaG: Sansarc	Shallow Clay	Favorable	2,200	Little bluestem	20
		Normal	2,000	Big bluestem	15
		Unfavorable	1,500	Sideoats grama	15
				Needleandthread	15
				Green needlegrass	10
				Blue grama	5
				Sedge	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
ScF: Schamber	Shallow To Gravel	Favorable	1,750	Blue grama	20
		Normal	1,250	Needleandthread	15
		Unfavorable	750	Sedge	10
				Sand bluestem	10
				Prairie sandreed	10
				Sand dropseed	10
				Little bluestem	5
				Hairy grama	5
SmF*:					
Simeon	Shallow To Gravel	Favorable	2,500	Blue grama	20
		Normal	1,500	Sand bluestem	10
		Unfavorable	1,000	Prairie sandreed	10
				Needleandthread	10
				Hairy grama	5
				Little bluestem	5
				Sand dropseed	5
				Scribner panicum	5
				Sedge	5
				Leadplant	5
Manter	Sandy	Favorable	3,250	Prairie sandreed	20
		Normal	2,500	Sand bluestem	15
		Unfavorable	1,500	Little bluestem	15
				Needleandthread	15
				Blue grama	10
				Switchgrass	5
				Sedge	5
Ronson	Sandy	Favorable	3,000	Sand bluestem	20
		Normal	2,500	Little bluestem	15
		Unfavorable	1,500	Prairie sandreed	15
				Needleandthread	15
				Blue grama	10
				Switchgrass	5
				Sedge	5
SvF2*:					
Simeon	Shallow To Gravel	Favorable	2,500	Blue grama	20
		Normal	1,500	Sand bluestem	10
		Unfavorable	1,000	Prairie sandreed	10
				Needleandthread	10
				Hairy grama	5
				Little bluestem	5
				Sand dropseed	5
				Scribner panicum	5
				Sedge	5
				Leadplant	5
Valentine	Sands	Favorable	3,000	Prairie sandreed	20
		Normal	2,400	Sand bluestem	18
		Unfavorable	1,800	Little bluestem	15
				Sand lovegrass	10
				Switchgrass	8
				Needleandthread	8
				Blue grama	5
				Sand dropseed	5
SwB*:					
Simeon	Shallow To Gravel	Favorable	2,500	Blue grama	20
		Normal	1,500	Sand bluestem	10
		Unfavorable	1,000	Prairie sandreed	10
				Needleandthread	10
				Hairy grama	5
				Little bluestem	5
				Sand dropseed	5
				Scribner panicum	5
				Sedge	5
				Leadplant	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
SwB*:					
Valentine	Sands	Favorable	3,000	Little bluestem	28
		Normal	2,200	Sand bluestem	15
		Unfavorable	1,200	Prairie sandreed	15
				Blue grama	10
				Sand dropseed	8
				Needleandthread	5
				Prairie junegrass	5
				Sedge	5
TaF: Tassel	Shallow Limy	Favorable	2,500	Needleandthread	30
		Normal	2,250	Threadleaf sedge	20
		Unfavorable	1,750	Blue grama	16
				Sand bluestem	5
				Little bluestem	5
				Broom snakeweed	5
TdE*:					
Tassel	Shallow Limy	Favorable	2,500	Needleandthread	30
		Normal	2,250	Threadleaf sedge	20
		Unfavorable	1,750	Blue grama	16
				Sand bluestem	5
				Little bluestem	5
				Broom snakeweed	5
Duda	Sandy	Favorable	3,000	Sand bluestem	30
		Normal	2,500	Prairie sandreed	20
		Unfavorable	1,750	Little bluestem	15
				Needleandthread	10
				Switchgrass	5
				Sand dropseed	5
				Blue grama	5
				Sedge	5
TrG*:					
Tassel	Shallow Limy	Favorable	2,500	Needleandthread	30
		Normal	2,250	Threadleaf sedge	20
		Unfavorable	1,750	Blue grama	16
				Sand bluestem	5
				Little bluestem	5
				Broom snakeweed	5
Ronson	Savannah	Favorable	3,000	Sand bluestem	15
		Normal	2,500	Little bluestem	10
		Unfavorable	1,750	Prairie sandreed	10
				Needleandthread	10
				Ponderosa pine	10
				Blue grama	5
				Switchgrass	5
				Sedge	5
				Eastern redcedar	5
Duda	Savannah	Favorable	3,000	Sand bluestem	15
		Normal	2,500	Prairie sandreed	10
		Unfavorable	1,750	Little bluestem	10
				Needleandthread	10
				Ponderosa pine	10
				Switchgrass	5
				Blue grama	5
				Sedge	5
				Eastern redcedar	5
Tu: Tuthill	Sandy	Favorable	3,250	Sand bluestem	20
		Normal	2,500	Little bluestem	20
		Unfavorable	1,500	Prairie sandreed	15
				Needleandthread	15
				Blue grama	10
				Switchgrass	5
				Sedge	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
VaF: Valentine	Sands	Favorable	3,000	Prairie sandreed	20
		Normal	2,400	Sand bluestem	18
		Unfavorable	1,800	Little bluestem	15
				Sand lovegrass	10
				Switchgrass	8
				Needleandthread	8
				Blue grama	5
				Sand dropseed	5
VaG: Valentine	Choppy Sands	Favorable	2,800	Sand bluestem	21
		Normal	2,350	Little bluestem	20
		Unfavorable	1,500	Prairie sandreed	16
				Sand lovegrass	12
				Needleandthread	6
				Sand dropseed	6
				Blue grama	5
VbD: Valentine	Sands	Favorable	3,000	Prairie sandreed	20
		Normal	2,400	Sand bluestem	18
		Unfavorable	1,800	Little bluestem	15
				Sand lovegrass	10
				Switchgrass	8
				Needleandthread	8
				Blue grama	5
				Sand dropseed	5
VcF*:					
Valentine	Sands	Favorable	3,000	Prairie sandreed	20
		Normal	2,400	Sand bluestem	18
		Unfavorable	1,800	Little bluestem	15
				Sand lovegrass	10
				Switchgrass	8
				Needleandthread	8
				Blue grama	5
				Sand dropseed	5
Tassel	Shallow Limy	Favorable	2,500	Needleandthread	30
		Normal	2,250	Threadleaf sedge	20
		Unfavorable	1,750	Blue grama	16
				Sand bluestem	5
				Little bluestem	5
				Broom snakeweed	5
VdC*:					
Valentine	Sands	Favorable	3,000	Prairie sandreed	20
		Normal	2,400	Sand bluestem	18
		Unfavorable	1,800	Little bluestem	15
				Sand lovegrass	10
				Switchgrass	8
				Needleandthread	8
				Blue grama	5
				Sand dropseed	5
Valentine, clayey substratum	Sandy	Favorable	3,000	Little bluestem	25
		Normal	2,200	Sand bluestem	15
		Unfavorable	1,200	Prairie sandreed	15
				Needleandthread	10
				Switchgrass	5
				Blue grama	5
				Purple lovegrass	5
				Sedge	5
Wewela	Sandy	Favorable	3,000	Little bluestem	25
		Normal	2,500	Prairie sandreed	15
		Unfavorable	1,750	Sand bluestem	15
				Needleandthread	10
				Blue grama	10
				Western wheatgrass	5
				Switchgrass	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
VdF*:					
Valentine	Sands	Favorable	2,800	Sand bluestem	21
		Normal	2,350	Little bluestem	20
		Unfavorable	1,500	Prairie sandreed	16
				Sand lovegrass	12
				Needleandthread	6
				Sand dropseed	6
				Blue grama	5
Valentine, clayey substratum	Sandy	Favorable	3,000	Little bluestem	25
		Normal	2,200	Sand bluestem	15
		Unfavorable	1,200	Prairie sandreed	15
				Needleandthread	10
				Switchgrass	5
				Blue grama	5
				Purple lovegrass	5
				Sedge	5
Wewela	Sandy	Favorable	3,000	Little bluestem	25
		Normal	2,500	Prairie sandreed	15
		Unfavorable	1,750	Sand bluestem	15
				Needleandthread	10
				Blue grama	10
				Western wheatgrass	5
				Switchgrass	5
Ve, VeB, VeC Verdel	Clayey	Favorable	4,000	Big bluestem	25
		Normal	3,250	Western wheatgrass	25
		Unfavorable	1,500	Little bluestem	5
				Switchgrass	5
				Sedge	5
				Tall dropseed	5
				Blue grama	5
				Kentucky bluegrass	5
				Green needlegrass	5
Vo Vetal	Sandy	Favorable	3,250	Little bluestem	20
		Normal	2,500	Prairie sandreed	20
		Unfavorable	1,750	Needleandthread	10
				Blue grama	10
				Sand bluestem	10
				Switchgrass	10
				Western wheatgrass	5
Vt Vetal	Silty	Favorable	3,500	Little bluestem	20
		Normal	2,750	Big bluestem	15
		Unfavorable	2,000	Prairie sandreed	10
				Needleandthread	10
				Sideoats grama	10
				Blue grama	10
				Switchgrass	10
				Western wheatgrass	5
VtB Vetal	Silty	Favorable	3,500	Little bluestem	25
		Normal	2,750	Prairie sandreed	10
		Unfavorable	2,000	Needleandthread	10
				Sideoats grama	10
				Blue grama	10
				Big bluestem	10
				Western wheatgrass	5
				Switchgrass	5
VtC Vetal	Silty	Favorable	3,250	Little bluestem	25
		Normal	2,500	Prairie sandreed	10
		Unfavorable	1,750	Needleandthread	10
				Sideoats grama	10
				Blue grama	10
				Big bluestem	10
				Western wheatgrass	5
				Switchgrass	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
WeB: Wewela	Sandy	Favorable	3,250	Little bluestem	25
		Normal	2,750	Prairie sandreed	15
		Unfavorable	2,000	Sand bluestem	15
				Needleandthread	10
				Blue grama	10
				Switchgrass	10
				Western wheatgrass	5
WeC: Wewela	Sandy	Favorable	3,000	Little bluestem	25
		Normal	2,500	Prairie sandreed	15
		Unfavorable	1,750	Sand bluestem	15
				Needleandthread	10
				Blue grama	10
				Switchgrass	10
				Western wheatgrass	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
Ab: Albaton Variant	---	Redosier dogwood, common chokecherry.	Boxelder, Russian mulberry, Austrian pine, Scotch pine.	Golden willow, silver maple, American sycamore, green ash, honeylocust.	Eastern cottonwood.
AmB, An, AnC: Anselmo	American plum, skunkbush sumac, Amur honeysuckle, common chokecherry.	---	Eastern redcedar	Ponderosa pine, green ash, honeylocust, Austrian pine, Scotch pine, jack pine.	Eastern cottonwood.
Ba: Barney	Redosier dogwood	---	Golden willow	---	Eastern cottonwood.
Bo: Boel	American plum	Redosier dogwood, autumn-olive.	Eastern redcedar, Austrian pine, Russian mulberry, Scotch pine, Black Hills spruce.	Green ash, honeylocust, golden willow.	Eastern cottonwood.
Bt: Brocksburg	Skunkbush sumac, Siberian peashrub.	Russian-olive	Eastern redcedar, ponderosa pine, Austrian pine, Scotch pine.	Jack pine, honeylocust, green ash, common hackberry.	Eastern cottonwood.
Cb: Cass	Peking cotoneaster, lilac, American plum.	Common chokecherry, Amur honeysuckle, autumn-olive.	Eastern redcedar, Russian mulberry, Siberian crabapple.	Austrian pine, Scotch pine, ponderosa pine.	---
CcB. Cass					
DdB, DdC: Duda	Skunkbush sumac, American plum, Amur honeysuckle, common chokecherry.	---	Eastern redcedar	Jack pine, Scotch pine, green ash, honeylocust, ponderosa pine, Austrian pine.	Eastern cottonwood.
DuB: Dunday	American plum, skunkbush sumac, Amur honeysuckle, common chokecherry.	---	Eastern redcedar	Ponderosa pine, green ash, Austrian pine, honeylocust, Scotch pine, jack pine.	Eastern cottonwood.
DxB*:					
Dunday	American plum, skunkbush sumac, Amur honeysuckle, common chokecherry.	---	Eastern redcedar	Ponderosa pine, green ash, Austrian pine, honeylocust, Scotch pine, jack pine.	Eastern cottonwood.
Duda	Skunkbush sumac, American plum, Amur honeysuckle, common chokecherry.	---	Eastern redcedar	Jack pine, Scotch pine, green ash, honeylocust, ponderosa pine, Austrian pine.	Eastern cottonwood.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
Eo: Els	American plum	Autumn-olive, silver buffaloberry, redosier dogwood.	Eastern redcedar, Russian mulberry, Scotch pine, Austrian pine.	Green ash, honeylocust, golden willow.	Eastern cottonwood.
Es: Elsmere	American plum	Redosier dogwood, autumn-olive, common chokecherry.	Eastern redcedar, Russian mulberry, Scotch pine, Austrian pine.	Green ash, honeylocust, golden willow.	Eastern cottonwood.
Ho, HoC: Holt	Silver buffaloberry, skunkbush sumac, Siberian peashrub.	Rocky Mountain juniper, Russian-olive.	Siberian elm, ponderosa pine, eastern redcedar, Austrian pine, Scotch pine, jack pine.	---	---
HtC*, HtD*:					
Holt	Silver buffaloberry, skunkbush sumac, Siberian peashrub.	Rocky Mountain juniper, Russian-olive.	Siberian elm, ponderosa pine, eastern redcedar, Austrian pine, Scotch pine, jack pine.	---	---
Tassel.					
IfD: Inavale	---	Eastern redcedar, Rocky Mountain juniper.	Austrian pine, ponderosa pine, Scotch pine, jack pine.	---	---
IgB. Inavale					
IhB: Inavale	Amur honeysuckle, American plum, skunkbush sumac, common chokecherry.	---	Eastern redcedar	Austrian pine, Scotch pine, ponderosa pine, green ash, honeylocust, jack pine.	Eastern cottonwood.
IpB: Ipage	Amur honeysuckle, skunkbush sumac, common chokecherry, American plum.	---	Eastern redcedar	Ponderosa pine, green ash, honeylocust, Austrian pine, Scotch pine, jack pine.	Eastern cottonwood.
Ja, Jn, JnC: Jansen	Siberian peashrub, skunkbush sumac, silver buffaloberry.	Russian-olive	Eastern redcedar, Scotch pine, Austrian pine, ponderosa pine, jack pine.	---	---
JoB*:					
Jansen	Siberian peashrub, skunkbush sumac, silver buffaloberry.	Russian-olive	Eastern redcedar, Scotch pine, Austrian pine, ponderosa pine.	---	---
Meadin.					
LaD: Labu	Siberian peashrub, silver buffaloberry, lilac, skunkbush sumac.	Rocky Mountain juniper, Russian-olive, eastern redcedar.	---	---	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
LcF*:					
Labu	Siberian peashrub, silver buffaloberry, lilac, skunkbush sumac.	Rocky Mountain juniper, Russian-olive, eastern redcedar.	---	---	---
Sansarc.					
Lo, Lp: Loup	Redosier dogwood	---	Golden willow	---	Eastern cottonwood.
MaB, MaC, MfC: Manter	Skunkbush sumac, Amur honeysuckle, common chokecherry, American plum.	---	Russian-olive, eastern redcedar.	Austrian pine, jack pine, scotch pine, ash, honeylocust.	Eastern cottonwood.
MkG*: Mariaville.					
Keota.					
Mm. Marlake					
MnF. Meadin					
Mu: Munjor	Skunkbush sumac, Amur honeysuckle, common chokecherry, American plum.	---	Eastern redcedar	Ponderosa pine, honeylocust, green ash, jack pine, Scotch pine, Austrian pine.	Eastern cottonwood.
OaB, Oe, OeC, OeD: O'Neill	Siberian peashrub, skunkbush sumac, silver buffaloberry.	Russian-olive	Eastern redcedar, ponderosa pine, Austrian pine, jack pine, Scotch pine.	---	---
OhB*:					
O'Neill	Siberian peashrub, skunkbush sumac, silver buffaloberry.	Russian-olive	Eastern redcedar, ponderosa pine, Austrian pine, jack pine, Scotch pine.	---	---
Meadin.					
OkD*:					
O'Neill	Siberian peashrub, skunkbush sumac, silver buffaloberry.	Russian-olive	Eastern redcedar, ponderosa pine, Austrian pine, jack pine, Scotch pine.	---	---
Valentine	---	---	Eastern redcedar, Austrian pine, ponderosa pine, Scotch pine, jack pine.	---	---
On: Onita	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
Or*:					
Ord	American plum	Redosier dogwood, autumn-olive, common chokecherry.	Eastern redcedar, Austrian pine, Scotch pine, boxelder.	Green ash, honeylocust, golden willow.	Eastern cottonwood.
Loup	Redosier dogwood	---	Golden willow	---	Eastern cottonwood.
Pf Paka	Skunkbush sumac, Amur honeysuckle, common chokecherry, American plum.	---	Eastern redcedar	Austrian pine, ponderosa pine, Scotch pine, honeylocust, green ash, jack pine.	Eastern cottonwood.
Ph, PhB Paka	Peking cotoneaster, skunkbush sumac, lilac.	Amur maple, autumn-olive, Amur honeysuckle.	Eastern redcedar, Russian mulberry, green ash.	Ponderosa pine, honeylocust, Austrian pine.	---
PmC*:					
Paka	Peking cotoneaster, skunkbush sumac, lilac.	Amur maple, autumn-olive, Amur honeysuckle.	Eastern redcedar, Russian mulberry, green ash.	Ponderosa pine, honeylocust, Austrian pine.	---
Mariaville.					
PmF*:					
Paka.					
Mariaville.					
RaB Ree	Lilac, Peking cotoneaster, skunkbush sumac.	Common chokecherry, Siberian peashrub, American plum.	Green ash, common hackberry, Russian-olive.	Ponderosa pine, Scotch pine, honeylocust.	---
Rb Ree	Lilac, Peking cotoneaster.	Siberian peashrub, silver buffaloberry, common chokecherry, American plum.	Green ash, Russian-olive, eastern redcedar.	Common hackberry, ponderosa pine, Austrian pine.	---
ReC Reliance	Lilac, Peking cotoneaster, skunkbush sumac.	Common chokecherry, Siberian peashrub, American plum.	Green ash, common hackberry, Russian-olive.	Ponderosa pine, Scotch pine, Austrian pine.	---
RoD*:					
Ronson	Skunkbush sumac, Siberian peashrub.	Russian-olive, Rocky Mountain juniper.	Eastern redcedar, ponderosa pine, Austrian pine, Scotch pine, jack pine.	---	---
Anselmo	American plum skunkbush sumac, Amur honeysuckle, common chokecherry.	---	Eastern redcedar	Ponderosa pine, green ash, honeylocust, Austrian pine, Scotch pine, jack pine.	Eastern cottonwood.
RoF*:					
Ronson.					

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
RoF*: Anselmo.					
RtB*: Ronson	Skunkbush sumac, Siberian peashrub.	Russian-olive, Rocky Mountain juniper.	Eastern redcedar, ponderosa pine, Austrian pine, Scotch pine, jack pine.	---	---
Tassel.					
SaG. Sansarc					
ScF. Schamber					
SmF*: Simeon.					
Manter	American plum, common choke-cherry, Amur honeysuckle, skunkbush sumac.	---	---	Ponderosa pine, Austrian pine, Scotch pine, jack pine.	Eastern cottonwood.
Ronson	Skunkbush sumac, Siberian peashrub.	Russian-olive	Eastern redcedar, jack pine, ponderosa pine, Scotch pine, Austrian pine.	---	---
SvF2*, SwB*: Simeon.					
Valentine	---	---	Eastern redcedar, Austrian pine, ponderosa pine, Scotch pine, jack pine.	---	---
TaF. Tassel					
TdE*: Tassel.					
Duda	Skunkbush sumac, American plum, Amur honeysuckle, common chokecherry.	---	Eastern redcedar	Jack pine, Scotch pine, green ash, honeylocust, ponderosa pine, Austrian pine.	Eastern cottonwood.
TrG*: Tassel.					
Ronson.					
Duda.					
Tu Tuthill	Lilac	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
VaF---------------- Valentine	---	---	Eastern redcedar, Austrian pine, ponderosa pine, Scotch pine, jack pine.	---	---
VaG. Valentine					
VbD---------------- Valentine	---	---	Eastern redcedar, Austrian pine, ponderosa pine, Scotch pine, jack pine.	---	---
VcF*:					
Valentine---------	---	---	Eastern redcedar, Austrian pine, ponderosa pine, Scotch pine, jack pine.	---	---
Tassel.					
VdC*:					
Valentine---------	---	---	Eastern redcedar, Austrian pine, ponderosa pine, Scotch pine, jack pine.	---	---
Valentine, clayey substratum------	---	---	Eastern redcedar, Austrian pine, ponderosa pine, Scotch pine, jack pine.	---	---
Wewela-----------	Lilac, Siberian peashrub, skunkbush sumac, silver buffalo-berry.	Russian-olive, Rocky Mountain, juniper.	Siberian elm, ponderosa pine, eastern redcedar, Austrian pine, jack pine.	---	---
VdF*:					
Valentine.					
Valentine, clayey substratum.					
Wewela.					
Ve, VeB, VeC------ Verdel	Skunkbush sumac, Siberian peashrub.	Eastern redcedar, Rocky Mountain juniper, Russian-olive.	Siberian elm------	---	---
Vo----------------- Vetal	Skunkbush sumac, Amur honeysuckle, common choke-cherry, American plum.	---	Eastern redcedar--	Ponderosa pine, Austrian pine, jack pine, green ash, honeylocust.	Eastern cottonwood.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Vt, VtB, VtC------ Vetal	American plum, lilac, Peking cotoneaster.	Siberian crabapple, common chokecherry, Siberian peashrub.	Russian-olive, eastern redcedar, green ash.	Ponderosa pine, Austrian pine, honeylocust.	---
WeB, WeC---------- Wewela	Lilac, Siberian peashrub, skunkbush sumac.	Russian-olive, eastern redcedar, Rocky Mountain juniper.	Siberian elm------	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Ab-------------------- Albaton Variant	Severe: floods, wetness, too clayey.	Severe: wetness, too clayey.	Severe: too clayey, wetness, floods.	Severe: too clayey.	Severe: too clayey, floods.
AmB------------------- Anselmo	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
An-------------------- Anselmo	Slight----------	Slight----------	Slight----------	Slight------------	Slight.
AnC------------------- Anselmo	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
Ba-------------------- Barney	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: floods.
Bo-------------------- Boel	Severe: floods.	Moderate: wetness.	Moderate: wetness, floods.	Slight------------	Moderate: wetness, floods.
Bt-------------------- Brocksburg	Slight----------	Slight----------	Slight----------	Slight------------	Slight.
Cb-------------------- Cass	Severe: floods.	Slight----------	Slight----------	Slight------------	Slight.
CcB------------------- Cass	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
DdB------------------- Duda	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, depth to rock.	Moderate: too sandy.	Moderate: too sandy, thin layer.
DdC------------------- Duda	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy, depth to rock.	Moderate: too sandy.	Moderate: too sandy, thin layer.
DuB------------------- Dunday	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
DxB*:					
Dunday---------------	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Duda-----------------	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, depth to rock.	Moderate: too sandy.	Moderate: too sandy, thin layer.
Eo-------------------- Els	Severe: floods, too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Poor: too sandy.
Es-------------------- Elsmere	Severe: floods.	Moderate: wetness, too sandy.	Moderate: too sandy, wetness.	Moderate: too sandy.	Moderate: too sandy.
Ho-------------------- Holt	Slight----------	Slight----------	Moderate: depth to rock.	Slight------------	Moderate: thin layer.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
HoC: Holt	Slight	Slight	Moderate: slope, depth to rock.	Slight	Moderate: thin layer.
HtC*:					
Holt	Slight	Slight	Moderate: slope, depth to rock.	Slight	Moderate: thin layer.
Tassel	Slight	Slight	Severe: depth to rock.	Slight	Severe: thin layer.
HtD*:					
Holt	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: thin layer, slope.
Tassel	Moderate: slope.	Moderate: slope.	Severe: depth to rock, slope.	Slight	Severe: thin layer.
IfD: Inavale	Severe: floods, too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
IgB: Inavale	Severe: floods, too sandy.	Severe: too sandy.	Moderate: floods.	Severe: too sandy.	Severe: too sandy, floods.
IhB: Inavale	Severe: floods.	Moderate: too sandy.	Slight	Moderate: too sandy.	Moderate: too sandy.
IpB: Ipage	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Ja, Jn: Jansen	Slight	Slight	Slight	Slight	Slight.
JnC: Jansen	Slight	Slight	Moderate: slope.	Slight	Slight.
JoB*:					
Jansen	Slight	Slight	Slight	Slight	Slight.
Meadin	Slight	Slight	Slight	Slight	Slight.
LaD: Labu	Moderate: slope, too clayey.	Moderate: slope, too clayey.	Severe: slope, too clayey.	Moderate: too clayey.	Severe: too clayey.
LcF*:					
Labu	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Moderate: too clayey, slope.	Severe: slope, too clayey.
Sansarc	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, too clayey, depth to rock.	Moderate: too clayey, slope.	Severe: slope, too clayey, thin layer.
Lo, Lp: Loup	Severe: wetness, floods.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
MaB: Manter	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
MaC Manter	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Moderate: too sandy.
MfC Manter	Slight	Slight	Moderate: slope.	Slight	Slight.
MkG*:					
Mariaville	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, thin layer.
Keota	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.	Severe: slope.
Mm Marlake	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
MnF Meadin	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.
Mu Munjor	Severe: floods.	Slight	Slight	Slight	Slight.
OaB O'Neill	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Oe O'Neill	Slight	Slight	Slight	Slight	Slight.
OeC O'Neill	Slight	Slight	Moderate: slope.	Slight	Slight.
OeD O'Neill	Slight	Slight	Severe: slope.	Slight	Slight.
OhB*:					
O'Neill	Slight	Slight	Slight	Slight	Slight.
Meadin	Slight	Slight	Slight	Slight	Slight.
OkD*:					
O'Neill	Slight	Slight	Moderate: slope.	Slight	Slight.
Valentine	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
On Onita	Slight	Slight	Slight	Slight	Slight.
Or*:					
Ord	Severe: floods.	Moderate: wetness.	Moderate: floods, wetness.	Slight	Moderate: floods, wetness.
Loup	Severe: wetness, floods.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Pf, Ph Paka	Slight	Slight	Slight	Slight	Slight.
PhB Paka	Slight	Slight	Moderate: slope.	Slight	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
PmC*:					
Paka	Slight	Slight	Moderate: slope.	Slight	Slight.
Mariaville	Slight	Slight	Severe: depth to rock.	Slight	Severe: thin layer.
PmF*:					
Paka	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Mariaville	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Moderate: slope.	Severe: slope, thin layer.
RaB Ree	Slight	Slight	Moderate: slope.	Slight	Slight.
Rb Ree	Slight	Slight	Slight	Slight	Slight.
ReC Reliance	Moderate: too clayey.	Slight	Moderate: slope.	Slight	Slight.
RoD*:					
Ronson	Slight	Slight	Severe: slope.	Slight	Moderate: thin layer.
Anselmo	Slight	Slight	Severe: slope.	Slight	Slight.
RoF*:					
Ronson	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Anselmo	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
RtB*:					
Ronson	Slight	Slight	Moderate: depth to rock.	Slight	Moderate: thin layer.
Tassel	Slight	Slight	Severe: depth to rock.	Slight	Slight.
SaG Sansarc	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, too clayey, depth to rock.	Severe: slope.	Severe: slope, too clayey, thin layer.
ScF Schamber	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: small stones, slope.	Severe: small stones, slope.
SmF*:					
Simeon	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: too sandy.
Manter	Moderate: too sandy, slope.	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy.	Moderate: too sandy, slope.
Ronson	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: thin layer, slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
SvF2*:					
Simeon	Severe: too sandy.	Severe: too sandy.	Severe: slope.	Severe: too sandy.	Severe: too sandy.
Valentine	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: too sandy.
SwB*:					
Simeon	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Valentine	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
TaF Tassel	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Moderate: too sandy, slope.	Severe: slope, thin layer.
TdE*:					
Tassel	Moderate: slope.	Moderate: slope.	Severe: depth to rock, slope.	Slight	Severe: thin layer.
Duda	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: slope, too sandy.
TrG*:					
Tassel	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope, thin layer.
Ronson	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Duda	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Tu Tuthill	Slight	Slight	Slight	Slight	Slight.
VaF Valentine	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: too sandy.
VaG Valentine	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.
VbD Valentine	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: slope, too sandy.
VcF*:					
Valentine	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: too sandy.
Tassel	Moderate: slope.	Moderate: slope.	Severe: depth to rock, slope.	Slight	Severe: thin layer.
VdC*:					
Valentine	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: too sandy.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
VdC*:					
Valentine, clayey substratum	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: too sandy.
Wewela	Moderate: percs slowly, too sandy.	Moderate: too sandy.	Moderate: depth to rock, slope.	Moderate: too sandy.	Moderate: too sandy, thin layer.
VdF*:					
Valentine	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too sandy.	Severe: slope.
Valentine, clayey substratum	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.	Severe: slope.
Wewela	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy.	Severe: slope.
Ve Verdel	Slight	Slight	Moderate: too clayey, percs slowly.	Slight	Moderate: too clayey.
VeB, VeC Verdel	Slight	Slight	Moderate: slope, percs slowly, too clayey.	Slight	Moderate: too clayey.
Vo, Vt Vetal	Slight	Slight	Slight	Slight	Slight.
VtB, VtC Vetal	Slight	Slight	Moderate: slope.	Slight	Slight.
WeB Wewela	Moderate: percs slowly.	Slight	Moderate: depth to rock.	Slight	Moderate: thin layer.
WeC Wewela	Moderate: percs slowly.	Slight	Moderate: depth to rock, slope.	Slight	Moderate: thin layer.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Ab------------------ Albaton Variant	Poor	Fair	Fair	Poor	Fair	Fair	Poor	Good	Fair	Poor	Fair	Fair.
AmB----------------- Anselmo	Fair	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Good	Good	Very poor.	Good.
An------------------ Anselmo	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
AnC----------------- Anselmo	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Ba------------------ Barney	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
Bo------------------ Boel	Fair	Fair	Good	Good	Good	Good	Fair	Fair	Fair	Good	Poor	Fair.
Bt------------------ Brocksburg	Good	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Fair.
Cb------------------ Cass	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
CcB----------------- Cass	Poor	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
DdB----------------- Duda	Fair	Good	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
DdC----------------- Duda	Poor	Good	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
DuB----------------- Dunday	Fair	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
DxB*:												
Dunday--------------	Fair	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Duda----------------	Fair	Good	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Eo------------------ Els	Poor	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Fair.
Es------------------ Elsmere	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Fair.
Ho, HoC------------- Holt	Fair	Good	Good	Fair	Fair	Good	Poor	Very poor.	Good	Fair	Very poor.	Good.
HtC*, HtD*:												
Holt----------------	Fair	Good	Good	Fair	Fair	Good	Poor	Very poor.	Good	Fair	Very poor.	Good.
Tassel--------------	Very poor.	Poor	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.
IfD----------------- Inavale	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
IgB----------------- Inavale	Very poor.	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
IhB----------------- Inavale	Fair	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Good.
IpB----------------- Ipage	Poor	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
Ja------------------ Jansen	Fair	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Fair.
Jn------------------ Jansen	Good	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Fair.
JnC----------------- Jansen	Fair	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Fair.
JoB*:												
Jansen------------	Fair	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Meadin------------	Poor	Poor	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
LaD----------------- Labu	Fair	Good	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.	Fair.
LcF*:												
Labu--------------	Poor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Sansarc-----------	Very poor.	Very poor.	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Fair.
Lo, Lp-------------- Loup	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
MaB, MaC, MfC------- Manter	Fair	Good	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Fair.
MkG*:												
Mariaville--------	Poor	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
Keota-------------	Fair	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Mm------------------ Marlake	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	Very poor.
MnF----------------- Meadin	Very poor.	Poor	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
Mu------------------ Munjor	Good	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	Good.
OaB, Oe, OeC-------- O'Neill	Fair	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Fair.
OeD----------------- O'Neill	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
OhB*:												
O'Neill-----------	Fair	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
OhB*:												
Meadin	Poor	Poor	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
OkD*:												
O'Neill	Fair	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Fair.
Valentine	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
On Onita	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
Or*:												
Ord	Good	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair	Good.
Loup	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
Pf, Ph, PhB Paka	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
PmC*:												
Paka	Fair	Good	Good	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.	Good.
Mariaville	Poor	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
PmF*:												
Paka	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Mariaville	Poor	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
RaB Ree	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Rb Ree	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
ReC Reliance	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
RoD*:												
Ronson	Fair	Good	Good	Fair	Fair	Good	Poor	Very poor.	Good	Fair	Very poor.	Good.
Anselmo	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
RoF*:												
Ronson	Poor	Fair	Good	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.	Good.
Anselmo	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
RtB*:												
Ronson	Fair	Good	Good	Fair	Fair	Good	Poor	Very poor.	Good	Fair	Very poor.	Good.
Tassel	Very poor.	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
SaG----------------- Sansarc	Very poor.	Very poor.	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Fair.
ScF----------------- Schamber	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Poor.
SmF*:												
Simeon-------------	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Manter-------------	Poor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Ronson-------------	Poor	Fair	Good	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.	Good.
SvF2*:												
Simeon-------------	Poor	Poor	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Valentine----------	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
SwB*:												
Simeon-------------	Poor	Poor	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Valentine----------	Fair	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
TaF----------------- Tassel	Very poor.	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
TdE*:												
Tassel-------------	Very poor.	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
Duda---------------	Poor	Poor	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
TrG*:												
Tassel-------------	Very poor.	Very poor.	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Poor.
Ronson-------------	Very poor.	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Fair.
Duda---------------	Very poor.	Very poor.	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Fair.
Tu------------------ Tuthill	Fair	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
VaF----------------- Valentine	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
VaG----------------- Valentine	Very poor.	Very poor.	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
VbD----------------- Valentine	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
VcF*:												
Valentine----------	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
VcF*:												
Tassel	Very poor.	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
VdC*:												
Valentine	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Valentine, clayey substratum	Poor	Fair	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.	Fair.
Wewela	Fair	Good	Good	Fair	Fair	Good	Poor	Very poor.	Good	Fair	Very poor.	Good.
VdF*:												
Valentine	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Valentine, clayey substratum	Poor	Fair	Fair	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.	Fair.
Wewela	Poor	Poor	Good	Fair	Fair	Good	Poor	Very poor.	Fair	Fair	Very poor.	Good.
Ve, VeB: Verdel	Good	Good	Fair	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
VeC: Verdel	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
Vo, Vt, VtB: Vetal	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
VtC: Vetal	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
WeB, WeC: Wewela	Fair	Good	Good	Fair	Fair	Good	Poor	Very poor.	Good	Fair	Very poor.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ab----------------- Albaton Variant	Severe: wetness, floods, cutbanks cave.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: low strength, wetness, floods.	Severe: too clayey, floods.
AmB---------------- Anselmo	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action, low strength.	Moderate: too sandy.
An----------------- Anselmo	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action, low strength.	Slight.
AnC---------------- Anselmo	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action, low strength.	Slight.
Ba----------------- Barney	Severe: wetness, cutbanks cave, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods.
Bo----------------- Boel	Severe: wetness, floods, cutbanks cave.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: floods.	Moderate: wetness, floods.
Bt----------------- Brocksburg	Severe: cutbanks cave.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.	Slight.
Cb----------------- Cass	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.	Slight.
CcB---------------- Cass	Severe: floods, cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
DdB---------------- Duda	Severe: cutbanks cave.	Slight---------	Moderate: depth to rock.	Slight---------	Slight---------	Moderate: too sandy, thin layer.
DdC---------------- Duda	Severe: cutbanks cave.	Slight---------	Moderate: depth to rock.	Moderate: slope.	Slight---------	Moderate: too sandy, thin layer.
DuB---------------- Dunday	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: too sandy.
DxB*:						
Dunday------------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: too sandy.
Duda--------------	Severe: cutbanks cave.	Slight---------	Moderate: depth to rock.	Slight---------	Slight---------	Moderate: too sandy, thin layer.
Eo----------------- Els	Severe: wetness, cutbanks cave.	Severe: floods.	Severe: wetness, floods.	Severe: floods.	Moderate: wetness, frost action, floods.	Severe: too sandy.
Es----------------- Elsmere	Severe: wetness, cutbanks cave.	Severe: floods.	Severe: wetness, floods.	Severe: floods.	Moderate: wetness, frost action, floods.	Moderate: too sandy.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ho------------------ Holt	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Slight---------	Moderate: frost action.	Moderate: thin layer.
HoC----------------- Holt	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Moderate: slope.	Moderate: frost action.	Moderate: thin layer.
HtC*:						
Holt---------------	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Moderate: slope.	Moderate: frost action.	Moderate: thin layer.
Tassel-------------	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Severe: thin layer.
HtD*:						
Holt---------------	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: frost action, slope.	Moderate: thin layer, slope.
Tassel-------------	Severe: slope, depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: slope, depth to rock.	Severe: thin layer.
IfD----------------- Inavale	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.	Severe: too sandy.
IgB----------------- Inavale	Severe: cutbanks cave, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: too sandy.
IhB----------------- Inavale	Severe: cutbanks cave, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: too sandy.
IpB----------------- Ipage	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Moderate: frost action.	Moderate: too sandy.
Ja, Jn------------- Jansen	Severe: cutbanks cave.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.	Slight.
JnC----------------- Jansen	Severe: cutbanks cave.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, slope, low strength.	Severe: low strength.	Slight.
JoB*:						
Jansen-------------	Severe: cutbanks cave.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.	Slight.
Meadin-------------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
LaD----------------- Labu	Moderate: slope, depth to rock, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell.	Severe: slope, shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: too clayey.
LcF*:						
Labu---------------	Severe: slope.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, too clayey.
Sansarc------------	Severe: slope, depth to rock.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, depth to rock.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, too clayey, thin layer.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Lo, Lp Loup	Severe: wetness, cutbanks cave, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness.
MaB Manter	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength, frost action.	Moderate: too sandy.
MaC, MfC Manter	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength, frost action.	Moderate: too sandy.
MkG*: Mariaville	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
Keota	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Mm Marlake	Severe: wetness, floods, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
MnF Meadin	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, small stones.
Mu Munjor	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.	Slight.
OaB O'Neill	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action, low strength.	Moderate: too sandy.
Oe O'Neill	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action, low strength.	Slight.
OeC, OeD O'Neill	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action, low strength.	Slight.
OhB*: O'Neill	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action, low strength.	Slight.
Meadin	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
OkD*: O'Neill	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action, low strength.	Slight.
Valentine	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: too sandy.
On Onita	Slight	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Or*:						
Ord	Severe: cutbanks cave, wetness, floods.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: frost action, floods.	Moderate: floods, wetness.
Loup	Severe: cutbanks cave, wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness.
Pf, Ph, PhB: Paka	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.	Slight.
PmC*:						
Paka	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: low strength.	Slight.
Mariaville	Moderate: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock, slope.	Moderate: depth to rock, frost action.	Severe: thin layer.
PmF*:						
Paka	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Mariaville	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
RaB: Ree	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.	Slight.
Rb: Ree	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Slight.
ReC: Reliance	Slight	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: low strength.	Slight.
RoD*:						
Ronson	Moderate: depth to rock.	Moderate: slope.	Moderate: slope.	Moderate: slope.	Moderate: low strength, frost action.	Moderate: thin layer.
Anselmo	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Moderate: slope.	Moderate: frost action, low strength.	Slight.
RoF*:						
Ronson	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Anselmo	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
RtB*:						
Ronson	Moderate: depth to rock.	Slight	Slight	Slight	Moderate: low strength, frost action.	Moderate: thin layer.
Tassel	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: thin layer.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
SaG---------------- Sansarc	Severe: slope, depth to rock.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, depth to rock.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, too clayey, thin layer.
ScF---------------- Schamber	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
SmF*:						
Simeon------------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: too sandy.
Manter------------	Moderate: slope.	Moderate: slope, low strength.	Moderate: slope, low strength.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: too sandy.
Ronson------------	Moderate: slope, depth to rock.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope, low strength, frost action.	Moderate: thin layer, slope.
SvF2*:						
Simeon------------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: too sandy.
Valentine---------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: too sandy.
SwB*:						
Simeon------------	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: too sandy.
Valentine---------	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: too sandy.
TaF---------------- Tassel	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
TdE*:						
Tassel------------	Moderate: slope, depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: slope, depth to rock.	Severe: thin layer.
Duda--------------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope.	Moderate: too sandy, slope.
TrG*:						
Tassel------------	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
Ronson------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Duda--------------	Severe: cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Tu----------------- Tuthill	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Slight.
VaF---------------- Valentine	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: too sandy.
VaG---------------- Valentine	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, too sandy.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
VbD: alentine	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope, too sandy.
VcF*:						
Valentine	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: too sandy.
Tassel	Moderate: slope, depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: slope, depth to rock.	Severe: thin layer.
VdC*:						
Valentine	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: too sandy.
Valentine, clayey substratum	Moderate: too clayey.	Slight	Severe: shrink-swell, low strength.	Moderate: slope.	Slight	Moderate: too sandy.
Wewela	Moderate: too clayey, depth to rock.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Moderate: too sandy, thin layer.
VdF*:						
Valentine	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Valentine, clayey substratum	Severe: slope.	Severe: slope.	Severe: slope, shrink-swell, low strength.	Severe: slope.	Severe: slope.	Severe: slope.
Wewela	Severe: slope.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, low strength.	Severe: slope.
Ve, VeB, VeC: Verdel	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Sever : shrink-swell, low strength.	Moderate: too clayey.
Vo, Vt, VtB: Vetal	Slight	Slight	Slight	Slight	Moderate: low strength, frost action.	Slight.
VtC: Vetal	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength, frost action.	Slight.
WeB, WeC: Wewela	Moderate: too clayey, depth to rock.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Moderate: thin layer.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ab: Albaton Variant	Severe: floods, percs slowly, wetness.	Severe: wetness, floods, seepage.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Poor: too clayey, wetness.
AmB, An, AnC: Anselmo	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Ba: Barney	Severe: floods, wetness.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Poor: wetness.
Bo: Boel	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Severe: wetness, floods, seepage.	Severe: floods, seepage, wetness.	Poor: too sandy.
Bt: Brocksburg	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy, seepage.
Cb: Cass	Moderate: floods.	Severe: seepage, floods.	Severe: seepage.	Severe: seepage.	Good.
CcB: Cass	Severe: floods.	Severe: seepage, floods.	Severe: floods, seepage.	Severe: seepage, floods.	Good.
DdB, DdC: Duda	Severe: depth to rock.	Severe: seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: area reclaim.
DuB: Dunday	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
DxB*:					
Dunday	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Duda	Severe: depth to rock.	Severe: seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: area reclaim.
Eo: Els	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy, seepage.
Es: Elsmere	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage, too sandy.	Severe: wetness, seepage.	Poor: too sandy.
Ho, HoC: Holt	Severe: depth to rock.	Severe: seepage.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: area reclaim.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
HtC*:					
Holt	Severe: depth to rock.	Severe: seepage.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: area reclaim.
Tassel	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage, depth to rock.	Poor: area reclaim.
HtD*:					
Holt	Severe: depth to rock.	Severe: seepage, slope.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: area reclaim.
Tassel	Severe: depth to rock.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Severe: seepage, depth to rock.	Poor: area reclaim.
IfD Inavale	Moderate: floods.	Severe: seepage, slope, floods.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
IgB Inavale	Severe: floods.	Severe: seepage, floods.	Severe: seepage, too sandy, floods.	Severe: seepage, floods.	Poor: too sandy.
IhB Inavale	Severe: floods.	Severe: seepage, floods.	Severe: seepage, too sandy, floods.	Severe: seepage, floods.	Poor: too sandy.
IpB Ipage	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: too sandy.
Ja, Jn, JnC Jansen	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
JoB*:					
Jansen	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Meadin	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
LaD Labu	Severe: depth to rock, percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock, slope.	Poor: too clayey, area reclaim.
LcF*:					
Labu	Severe: depth to rock, slope, percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Severe: slope.	Poor: slope, too clayey, area reclaim.
Sansarc	Severe: slope, percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: too clayey, depth to rock.	Severe: slope, depth to rock.	Poor: slope, too clayey, area reclaim.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Lo, Lp Loup	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Severe: wetness, seepage, floods.	Severe: wetness, seepage, floods.	Poor: wetness, too sandy, seepage.
MaB, MaC, MfC Manter	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
MkG*:					
Mariaville	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: slope, area reclaim.
Keota	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: slope.	Poor: slope.
Mm Marlake	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Severe: wetness, seepage, floods.	Severe: wetness, seepage, floods.	Poor: wetness, too sandy, seepage.
MnF Meadin	Severe: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage, slope.	Poor: slope, small stones, seepage.
Mu Munjor	Moderate: floods.	Severe: seepage, floods.	Severe: seepage.	Severe: seepage.	Good.
OaB, Oe, OeC O'Neill	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
OeD O'Neill	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
OhB*:					
O'Neill	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Meadin	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
OkD*:					
O'Neill	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Valentine	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
On Onita	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey, hard to pack.
Or*:					
Ord	Severe: wetness, floods.	Severe: wetness, floods, seepage.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Fair: too sandy.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Or*:					
Loup	Severe: floods, wetness.	Severe: wetness, seepage, floods.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Poor: wetness, too sandy, seepage.
Pf, Ph Paka	Moderate: percs slowly, depth to rock.	Moderate: seepage.	Severe: depth to rock.	Slight	Fair: too clayey, area reclaim.
PhB Paka	Moderate: percs slowly, depth to rock.	Moderate: seepage, slope.	Severe: depth to rock.	Slight	Fair: too clayey, area reclaim.
PmC*:					
Paka	Moderate: percs slowly, depth to rock.	Moderate: seepage, slope.	Severe: depth to rock.	Slight	Fair: too clayey, area reclaim.
Mariaville	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
PmF*:					
Paka	Severe: slope.	Severe: slope.	Severe: depth to rock.	Severe: slope.	Poor: slope.
Mariaville	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: slope, depth to rock.	Poor: slope, area reclaim.
RaB Ree	Moderate: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Rb Ree	Severe: percs slowly, depth to rock.	Moderate: seepage.	Severe: depth to rock.	Slight	Fair: too clayey.
ReC Reliance	Severe: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
RoD*:					
Ronson	Severe: depth to rock.	Severe: slope, seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: area reclaim.
Anselmo	Slight	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Good.
RoF*:					
Ronson	Severe: slope, depth to rock.	Severe: slope, seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: slope, seepage.	Poor: slope, area reclaim.
Anselmo	Severe: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage, slope.	Poor: slope.
RtB*:					
Ronson	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: area reclaim.
Tassel	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: seepage, depth to rock.	Severe: seepage, depth to rock.	Poor: area reclaim.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
SaG----------------- Sansarc	Severe: slope, percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: slope, too clayey, depth to rock.	Severe: slope, depth to rock.	Poor: slope, too clayey, area reclaim.
ScF----------------- Schamber	Severe: slope.	Severe: slope, seepage.	Severe: seepage, too sandy.	Severe: slope, seepage.	Poor: slope, small stones, seepage.
SmF*:					
Simeon-------------	Moderate: slope.	Severe: slope, seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
Manter-------------	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Fair: slope.
Ronson-------------	Severe: depth to rock.	Severe: slope, seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: area reclaim.
SvF2*:					
Simeon-------------	Moderate: slope.	Severe: slope, seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
Valentine----------	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
SwB*:					
Simeon-------------	Slight-----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
Valentine----------	Slight-----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
TaF----------------- Tassel	Severe: slope, depth to rock.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Severe: seepage, slope, depth to rock.	Poor: slope, area reclaim.
TdE*:					
Tassel-------------	Severe: depth to rock.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Severe: seepage, depth to rock.	Poor: area reclaim.
Duda---------------	Severe: depth to rock.	Severe: seepage, slope.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: area reclaim.
TrG*:					
Tassel-------------	Severe: slope, depth to rock.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope, depth to rock.	Poor: slope, area reclaim.
Ronson-------------	Severe: slope, depth to rock.	Severe: slope, seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: slope, seepage.	Poor: slope, area reclaim.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
TrG*:					
Duda	Severe: depth to rock, slope.	Severe: seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, slope.
Tu: Tuthill	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Fair: too sandy.
VaF: Valentine	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
VaG: Valentine	Severe: slope.	Severe: seepage, slope.	Severe: seepage, too sandy, slope.	Severe: seepage, slope.	Poor: too sandy, slope, seepage.
VbD: Valentine	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
VcF*:					
Valentine	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Tassel	Severe: depth to rock.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Severe: seepage, depth to rock.	Poor: area reclaim.
VdC*:					
Valentine	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Valentine, clayey substratum	Severe: percs slowly, wetness.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Wewela	Severe: depth to rock, percs slowly.	Moderate: slope, depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Poor: area reclaim.
VdF*:					
Valentine	Severe: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage, slope.	Poor: too sandy, slope, seepage.
Valentine, clayey substratum	Severe: slope, percs slowly, wetness.	Severe: slope, seepage.	Severe: too sandy.	Severe: seepage, slope.	Poor: slope, seepage, too sandy.
Wewela	Severe: depth to rock, percs slowly.	Severe: slope.	Severe: depth to rock.	Severe: slope.	Poor: area reclaim.
Ve: Verdel	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
VeB, VeC: Verdel	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Vo, Vt, VtB, VtC: Vetal	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
WeB----------------- Wewela	Severe: depth to rock, percs slowly.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Poor: area reclaim.
WeC----------------- Wewela	Severe: depth to rock, percs slowly.	Moderate: slope, depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Poor: area reclaim.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ab: Albaton Variant	Poor: wetness, low strength, shrink-swell.	Fair: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
AmB: Anselmo	Fair: low strength.	Fair: excess fines.	Unsuited: excess fines.	Fair: too sandy.
An, AnC: Anselmo	Fair: low strength.	Fair: excess fines.	Unsuited: excess fines.	Good.
Ba: Barney	Poor: wetness.	Good	Fair: excess fines.	Poor: wetness.
Bo: Boel	Fair: wetness.	Good	Unsuited: excess fines.	Fair: thin layer.
Bt: Brocksburg	Good	Good	Unsuited: excess fines.	Fair: area reclaim.
Cb, CcB: Cass	Fair: low strength.	Fair: excess fines.	Unsuited: excess fines.	Good.
DdB, DdC: Duda	Poor: area reclaim.	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy, area reclaim.
DuB: Dunday	Good	Fair: excess fines.	Unsuited: excess fines.	Fair: too sandy.
DxB*:				
Dunday	Good	Fair: excess fines.	Unsuited: excess fines.	Fair: too sandy.
Duda	Poor: area reclaim.	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy, area reclaim.
Eo: Els	Fair: wetness.	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Es: Elsmere	Fair: wetness.	Fair: excess fines.	Unsuited: excess fines.	Fair: too sandy.
Ho, HoC: Holt	Poor: area reclaim.	Poor: excess fines.	Unsuited: excess fines.	Fair: area reclaim.
HtC*:				
Holt	Poor: area reclaim.	Poor: excess fines.	Unsuited: excess fines.	Fair: area reclaim.
Tassel	Poor: thin layer, area reclaim.	Poor: thin layer.	Unsuited: excess fines.	Poor: area reclaim.
HtD*:				
Holt	Poor: area reclaim.	Poor: excess fines.	Unsuited: excess fines.	Fair: area reclaim, slope.
Tassel	Poor: thin layer, area reclaim.	Poor: thin layer.	Unsuited: excess fines.	Poor: area reclaim.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
IfD, IgB: Inavale	Good	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
IhB: Inavale	Good	Fair: excess fines.	Unsuited: excess fines.	Fair: too sandy.
IpB: Ipage	Fair: frost action.	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Ja, Jn, JnC: Jansen	Good	Good	Unsuited: excess fines.	Fair: thin layer.
JoB*:				
Jansen	Good	Good	Unsuited: excess fines.	Fair: thin layer.
Meadin	Good	Good	Good	Poor: thin layer.
LaD: Labu	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
LcF*:				
Labu	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, too clayey.
Sansarc	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, too clayey, area reclaim.
Lo, Lp: Loup	Poor: wetness.	Fair: excess fines.	Unsuited: excess fines.	Poor: wetness.
MaB, MaC: Manter	Fair: low strength, frost action.	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
MfC: Manter	Fair: low strength, frost action.	Poor: excess fines.	Unsuited: excess fines.	Good.
MkG*:				
Mariaville	Poor: thin layer, slope, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, area reclaim.
Keota	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Mm: Marlake	Poor: wetness.	Fair: excess fines.	Unsuited: excess fines.	Poor: wetness, thin layer.
MnF: Meadin	Fair: slope.	Good	Good	Poor: area reclaim, slope, small stones.
Mu: Munjor	Fair: low strength.	Fair: excess fines.	Unsuited: excess fines.	Good.
OaB: O'Neill	Good	Good	Good	Fair: too sandy.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Oe, OeC, OeD: O'Neill	Good	Good	Good	Good.
OhB*:				
O'Neill	Good	Good	Good	Good.
Meadin	Good	Good	Good	Poor: thin layer.
OkD*:				
O'Neill	Good	Good	Good	Good.
Valentine	Good	Good	Unsuited: excess fines.	Poor: too sandy.
On: Onita	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Or*:				
Ord	Fair: wetness.	Poor: excess fines.	Unsuited: excess fines.	Good.
Loup	Poor: wetness.	Fair: excess fines.	Unsuited: excess fines.	Poor: wetness.
Pf, Ph, PhB: Paka	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
PmC*:				
Paka	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Mariaville	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: area reclaim.
PmF*:				
Paka	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Mariaville	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, area reclaim.
RaB: Ree	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Rb: Ree	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
ReC: Reliance	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
RoD*:				
Ronson	Poor: thin layer, area reclaim.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Fair: area reclaim.
Anselmo	Fair: low strength.	Fair: excess fines.	Unsuited: excess fines.	Good.
RoF*:				
Ronson	Poor: thin layer, area reclaim.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
RoF*:				
Anselmo	Fair: slope, low strength.	Fair: excess fines.	Unsuited: excess fines.	Poor: slope.
RtB*:				
Ronson	Poor: thin layer, area reclaim.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Fair: area reclaim.
Tassel	Poor: thin layer, area reclaim.	Poor: thin layer.	Unsuited: excess fines.	Poor: area reclaim.
SaG Sansarc	Poor: slope, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, too clayey, area reclaim.
ScF Schamber	Fair: slope.	Good	Good	Poor: slope, thin layer, small stones.
SmF*:				
Simeon	Good	Good	Unsuited: excess fines.	Poor: thin layer.
Manter	Fair: low strength, frost action.	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy, slope.
Ronson	Poor: thin layer, area reclaim.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Fair: area reclaim, slope.
SvF2*:				
Simeon	Good	Good	Unsuited: excess fines.	Poor: thin layer.
Valentine	Good	Good	Unsuited: excess fines.	Poor: too sandy.
SwB*:				
Simeon	Good	Good	Unsuited: excess fines.	Fair: too sandy.
Valentine	Good	Good	Unsuited: excess fines.	Fair: too sandy.
TaF Tassel	Poor: thin layer, area reclaim.	Poor: thin layer.	Unsuited: excess fines.	Poor: area reclaim, slope.
TdE*:				
Tassel	Poor: thin layer, area reclaim.	Poor: thin layer.	Unsuited: excess fines.	Poor: area reclaim.
Duda	Poor: area reclaim.	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy, area reclaim.
TrG*:				
Tassel	Poor: thin layer, slope, area reclaim.	Poor: thin layer.	Unsuited: excess fines.	Poor: area reclaim, slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
TrG*:				
Ronson	Poor: thin layer, area reclaim.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Poor: slope.
Duda	Poor: area reclaim.	Poor: excess fines.	Unsuited: excess fines.	Poor: slope.
Tu: Tuthill	Fair: shrink-swell, low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: thin layer.
VaF: Valentine	Good	Good	Unsuited: excess fines.	Poor: too sandy.
VaG: Valentine	Poor: slope.	Good	Unsuited: excess fines.	Poor: slope, too sandy.
VbD: Valentine	Good	Good	Unsuited: excess fines.	Fair: slope, too sandy.
VcF*:				
Valentine	Good	Good	Unsuited: excess fines.	Poor: too sandy.
Tassel	Poor: thin layer, area reclaim.	Poor: thin layer.	Unsuited: excess fines.	Poor: area reclaim.
VdC*:				
Valentine	Good	Good	Unsuited: excess fines.	Fair: too sandy.
Valentine, clayey substratum	Good	Poor: thin layer.	Unsuited: excess fines.	Fair: too sandy.
Wewela	Poor: shrink-swell, low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too sandy, area reclaim.
VdF*:				
Valentine	Fair: slope.	Good	Unsuited: excess fines.	Poor: slope.
Valentine, clayey substratum	Fair: slope.	Poor: thin layer.	Unsuited: excess fines.	Poor: slope.
Wewela	Poor: shrink-swell, low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Ve, VeB, VeC: Verdel	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Vo, Vt, VtB, VtC: Vetal	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
WeB, WeC: Wewela	Poor: shrink-swell, low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ab----------------- Albaton Variant	Seepage---------	Wetness, seepage.	Floods, frost action.	Floods, slow intake, wetness.	Not needed-----	Wetness.
AmB--------------- Anselmo	Seepage---------	Seepage, piping.	Not needed-----	Fast intake, soil blowing.	Not needed-----	Favorable.
An----------------- Anselmo	Seepage---------	Seepage, piping.	Not needed-----	Soil blowing---	Not needed-----	Favorable.
AnC--------------- Anselmo	Seepage---------	Seepage, piping.	Not needed-----	Soil blowing---	Soil blowing, too sandy.	Favorable.
Ba----------------- Barney	Seepage---------	Seepage, wetness.	Floods---------	Wetness, droughty, soil blowing.	Not needed-----	Wetness, droughty.
Bo----------------- Boel	Seepage---------	Seepage, piping.	Floods---------	Wetness, droughty, soil blowing.	Not needed-----	Droughty.
Bt----------------- Brocksburg	Seepage---------	Seepage---------	Not needed-----	Favorable------	Not needed-----	Favorable.
Cb----------------- Cass	Seepage---------	Seepage---------	Not needed-----	Soil blowing---	Not needed-----	Favorable.
CcB--------------- Cass	Seepage---------	Seepage---------	Not needed-----	Floods---------	Not needed-----	Favorable.
DdB--------------- Duda	Seepage, depth to rock.	Piping, seepage, thin layer.	Not needed-----	Droughty, fast intake, soil blowing.	Not needed-----	Droughty, depth to rock.
DdC--------------- Duda	Seepage, depth to rock.	Piping, seepage, thin layer.	Not needed-----	Droughty, fast intake, soil blowing.	Too sandy, soil blowing, depth to rock.	Droughty, depth to rock.
DuB--------------- Dunday	Seepage---------	Seepage, piping.	Not needed-----	Fast intake, soil blowing.	Not needed-----	Favorable.
DxB*:						
Dunday------------	Seepage---------	Seepage, piping.	Not needed-----	Fast intake, soil blowing.	Not needed-----	Favorable.
Duda--------------	Seepage, depth to rock.	Piping, seepage, thin layer.	Not needed-----	Droughty, fast intake, soil blowing.	Not needed-----	Droughty, depth to rock.
Eo----------------- Els	Seepage---------	Seepage---------	Favorable------	Fast intake, wetness, droughty.	Not needed-----	Droughty.
Es----------------- Elsmere	Seepage---------	Seepage, piping, wetness.	Favorable------	Wetness, fast intake, droughty.	Not needed-----	Droughty.
Ho----------------- Holt	Seepage, depth to rock.	Thin layer-----	Not needed-----	Rooting depth, soil blowing.	Not needed-----	Depth to rock.
HoC--------------- Holt	Seepage, depth to rock.	Thin layer-----	Not needed-----	Rooting depth, soil blowing.	Depth to rock, soil blowing.	Depth to rock.
HtC*:						
Holt--------------	Seepage, depth to rock.	Thin layer-----	Not needed-----	Rooting depth, soil blowing.	Depth to rock, soil blowing.	Depth to rock.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
HtC*:						
Tassel	Depth to rock	Thin layer	Not needed	Droughty, rooting depth, soil blowing.	Depth to rock, too sandy.	Droughty, rooting depth.
HtD*:						
Holt	Slope, seepage, depth to rock.	Thin layer	Not needed	Slope, rooting depth, soil blowing.	Depth to rock, soil blowing.	Slope, depth to rock.
Tassel	Slope, depth to rock.	Thin layer	Not needed	Droughty, rooting depth, soil blowing.	Depth to rock, too sandy.	Slope, droughty, rooting depth.
IfD Inavale	Seepage	Seepage, piping.	Not needed	Fast intake, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
IgB Inavale	Seepage	Seepage, piping.	Not needed	Floods	Not needed	Droughty.
IhB Inavale	Seepage	Seepage, piping.	Not needed	Fast intake, droughty, soil blowing.	Not needed	Droughty.
IpB Ipage	Seepage	Seepage	Not needed	Fast intake, droughty, soil blowing.	Not needed	Droughty.
Ja Jansen	Seepage	Seepage	Not needed	Soil blowing	Not needed	Favorable.
Jn Jansen	Seepage	Seepage	Not needed	Favorable	Not needed	Favorable.
JnC Jansen	Seepage	Seepage	Not needed	Favorable	Too sandy	Slope.
JoB*:						
Jansen	Seepage	Seepage	Not needed	Favorable	Not needed	Favorable.
Meadin	Seepage	Seepage	Not needed	Fast intake, droughty, soil blowing.	Not needed	Droughty.
LaD Labu	Slope, depth to rock.	Hard to pack, thin layer.	Not needed	Slow intake, percs slowly, rooting depth.	Depth to rock, percs slowly.	Slope, depth to rock, percs slowly.
LcF*:						
Labu	Slope, depth to rock.	Hard to pack, thin layer.	Not needed	Slow intake, percs slowly, rooting depth.	Slope, depth to rock, percs slowly.	Slope, depth to rock, percs slowly.
Sansarc	Depth to rock, slope.	Thin layer, hard to pack.	Not needed	Slope, slow intake, rooting depth.	Slope, depth to rock, percs slowly.	Slope, rooting depth, droughty.
Lo, Lp Loup	Seepage	Seepage, wetness.	Poor outlets, cutbanks cave.	Wetness, fast intake, soil blowing.	Not needed	Wetness.
MaB Manter	Seepage	Piping, low strength.	Slope	Droughty, slope, erodes easily.	Soil blowing, piping.	Erodes easily.
MaC, MfC Manter	Seepage	Piping, low strength.	Slope	Droughty, slope, erodes easily.	Soil blowing, piping.	Erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
MkG*:						
Mariaville	Slope, seepage, depth to rock.	Thin layer	Not needed	Rooting depth, slope, erodes easily.	Slope, depth to rock.	Slope, rooting depth, erodes easily.
Keota	Depth to rock, seepage, slope.	Thin layer, low strength, piping.	Percs slowly, slope, depth to rock.	Rooting depth, complex slope.	Depth to rock, complex slope.	Depth to rock, erodes easily, slope.
Mm: Marlake	Seepage	Seepage, wetness.	Floods	Wetness, droughty, fast intake.	Not needed	Wetness, droughty.
MnF: Meadin	Seepage, slope.	Seepage	Not needed	Fast intake, slope, droughty.	Slope, too sandy.	Droughty, slope.
Mu: Munjor	Seepage	Favorable	Not needed	Soil blowing	Soil blowing	Favorable.
OaB: O'Neill	Seepage	Seepage	Not needed	Droughty, fast intake, soil blowing.	Not needed	Droughty.
Oe: O'Neill	Seepage	Seepage	Not needed	Droughty	Not needed	Droughty.
OeC: O'Neill	Seepage	Seepage	Not needed	Droughty	Too sandy, soil blowing.	Droughty.
OeD: O'Neill	Slope, seepage.	Seepage	Not needed	Slope, droughty.	Too sandy, soil blowing.	Droughty.
OhB*:						
O'Neill	Seepage	Seepage	Not needed	Droughty	Not needed	Droughty.
Meadin	Seepage	Seepage	Not needed	Fast intake, droughty, soil blowing.	Not needed	Droughty.
OkD*:						
O'Neill	Seepage	Seepage	Not needed	Droughty	Too sandy, soil blowing.	Droughty.
Valentine	Seepage	Seepage, piping.	Not needed	Fast intake, soil blowing, droughty.	Soil blowing, too sandy.	Droughty.
On: Onita	Favorable	Hard to pack	Not needed	Favorable	Not needed	Erodes easily.
Or*:						
Ord	Seepage	Seepage, wetness.	Floods, frost action.	Wetness, soil blowing, droughty.	Not needed	Droughty.
Loup	Seepage	Seepage, wetness.	Floods	Wetness, fast intake, soil blowing.	Not needed	Wetness.
Pf: Paka	Seepage, depth to rock.	Thin layer	Not needed	Soil blowing	Not needed	Favorable.
Ph: Paka	Seepage, depth to rock.	Thin layer	Not needed	Favorable	Not needed	Favorable.
PhB: Paka	Seepage, depth to rock.	Thin layer	Not needed	Favorable	Favorable	Favorable.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
PmC*:						
Paka	Seepage, depth to rock.	Thin layer	Not needed	Favorable	Favorable	Favorable.
Mariaville	Seepage, depth to rock.	Thin layer	Not needed	Rooting depth, erodes easily.	Depth to rock	Rooting depth, erodes easily.
PmF*:						
Paka	Slope, seepage, depth to rock.	Thin layer	Not needed	Slope	Slope	Slope.
Mariaville	Slope, seepage, depth to rock.	Thin layer	Not needed	Rooting depth, slope, erodes easily.	Slope, depth to rock.	Slope, rooting depth, erodes easily.
RaB Ree	Seepage	Favorable	Not needed	Favorable	Favorable	Favorable.
Rb Ree	Favorable	Thin layer	Not needed	Favorable	Not needed	Favorable.
ReC Reliance	Favorable	Hard to pack	Not needed	Favorable	Favorable	Favorable.
RoD*:						
Ronson	Slope, seepage, depth to rock.	Piping, erodes easily.	Not needed	Slope, soil blowing, rooting depth.	Depth to rock, soil blowing.	Depth to rock.
Anselmo	Seepage, slope.	Seepage, piping.	Not needed	Soil blowing, slope.	Soil blowing, too sandy.	Favorable.
RoF*:						
Ronson	Slope, seepage, depth to rock.	Piping, erodes easily.	Not needed	Slope, soil blowing, rooting depth.	Slope, depth to rock, soil blowing.	Slope, depth to rock.
Anselmo	Seepage, slope.	Seepage, piping.	Not needed	Soil blowing, slope.	Slope, soil blowing, too sandy.	Slope.
RtB*:						
Ronson	Seepage, depth to rock.	Piping, erodes easily.	Not needed	Soil blowing, rooting depth.	Not needed	Depth to rock.
Tassel	Depth to rock	Thin layer	Not needed	Droughty, rooting depth, soil blowing.	Depth to rock	Droughty, rooting depth.
SaG Sansarc	Depth to rock, slope.	Thin layer, hard to pack.	Not needed	Slope, slow intake, rooting depth.	Slope, depth to rock, percs slowly.	Slope, rooting depth, droughty.
ScF Schamber	Slope, seepage.	Seepage	Not needed	Droughty, slope.	Slope, too sandy.	Slope, droughty.
SmF*:						
Simeon	Seepage	Seepage	Not needed	Fast intake, droughty, soil blowing.	Too sandy, soil blowing.	Slope, droughty.
Manter	Seepage	Piping, low strength.	Slope	Droughty, slope, erodes easily.	Soil blowing, piping, slope.	Erodes easily, slope.
Ronson	Slope, seepage, depth to rock.	Piping, erodes easily.	Not needed	Slope, soil blowing, rooting depth.	Depth to rock, soil blowing.	Slope, depth to rock.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
SvF2*:						
Simeon	Seepage	Seepage	Not needed	Fast intake, droughty, soil blowing.	Too sandy, soil blowing.	Slope, droughty.
Valentine	Seepage, slope.	Seepage, piping.	Not needed	Fast intake, soil blowing, droughty.	Soil blowing, too sandy.	Slope, droughty.
SwB*:						
Simeon	Seepage	Seepage	Not needed	Fast intake, droughty, soil blowing.	Not needed	Droughty.
Valentine	Seepage	Seepage, piping.	Not needed	Fast intake, soil blowing, droughty.	Not needed	Droughty.
TaF Tassel	Slope, depth to rock.	Thin layer	Not needed	Droughty, rooting depth, soil blowing.	Slope, depth to rock, too sandy.	Slope, droughty, rooting depth.
TdE*:						
Tassel	Slope, depth to rock.	Thin layer	Not needed	Droughty, rooting depth, soil blowing.	Depth to rock, too sandy.	Slope, droughty, rooting depth.
Duda	Slope, seepage, depth to rock.	Piping, seepage, thin layer.	Not needed	Slope, fast intake, soil blowing.	Slope	Droughty, slope, depth to rock.
TrG*:						
Tassel	Slope, depth to rock.	Thin layer	Not needed	Droughty, rooting depth, soil blowing.	Slope, depth to rock, too sandy.	Slope, droughty, rooting depth.
Ronson	Slope, seepage, depth to rock.	Piping, erodes easily.	Not needed	Slope, soil blowing, rooting depth.	Slope, depth to rock, soil blowing.	Slope, depth to rock.
Duda	Slope, seepage, depth to rock.	Piping, seepage, thin layer.	Not needed	Slope, fast intake, soil blowing.	Slope	Droughty, slope, depth to rock.
Tu Tuthill	Seepage	Piping	Not needed	Soil blowing	Not needed	Favorable.
VaF Valentine	Seepage, slope.	Seepage, piping.	Not needed	Fast intake, soil blowing, droughty.	Soil blowing, too sandy.	Slope, droughty.
VaG, VbD Valentine	Seepage, slope.	Seepage, piping.	Not needed	Fast intake, soil blowing, droughty.	Slope, soil blowing, too sandy.	Slope, droughty.
VcF*:						
Valentine	Seepage, slope.	Seepage, piping.	Not needed	Fast intake, soil blowing, droughty.	Soil blowing, too sandy.	Slope, droughty.
Tassel	Slope, depth to rock.	Thin layer	Not needed	Droughty, rooting depth, soil blowing.	Depth to rock, too sandy.	Slope, droughty, rooting depth.
VdC*:						
Valentine	Seepage	Seepage, piping.	Not needed	Fast intake, soil blowing, droughty.	Soil blowing, too sandy.	Droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
VdC*:						
Valentine, clayey substratum	Seepage	Seepage, piping.	Not needed	Fast intake, soil blowing, droughty.	Soil blowing, too sandy.	Droughty.
Wewela	Favorable	Hard to pack, thin layer.	Not needed	Percs slowly, soil blowing, rooting depth.	Depth to rock, soil blowing, percs slowly.	Percs slowly, depth to rock.
VdF*:						
Valentine	Seepage, slope.	Seepage, piping.	Not needed	Fast intake, soil blowing, droughty.	Slope, soil blowing, too sandy.	Slope, droughty.
Valentine, clayey substratum	Seepage, slope.	Seepage, piping.	Not needed	Fast intake, soil blowing, droughty.	Slope, soil blowing, too sandy.	Droughty, slope.
Wewela	Slope	Hard to pack, thin layer.	Not needed	Percs slowly, soil blowing, rooting depth.	Slope, soil blowing.	Percs slowly, slope, depth to rock.
Ve Verdel	Favorable	Hard to pack, piping.	Not needed	Percs slowly	Not needed	Percs slowly.
VeB, VeC Verdel	Favorable	Hard to pack, piping.	Not needed	Percs slowly	Percs slowly	Percs slowly.
Vo Vetal	Seepage	Piping	Not needed	Soil blowing	Not needed	Favorable.
Vt Vetal	Seepage	Piping	Not needed	Favorable	Not needed	Favorable.
VtB, VtC Vetal	Seepage	Piping	Not needed	Favorable	Favorable	Favorable.
WeB Wewela	Favorable	Hard to pack, thin layer.	Not needed	Percs slowly, soil blowing, rooting depth.	Not needed	Percs slowly, depth to rock.
WeC Wewela	Favorable	Hard to pack, thin layer.	Not needed	Percs slowly, soil blowing, rooting depth.	Depth to rock, soil blowing, percs slowly.	Percs slowly, depth to rock.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ab: Albaton Variant	0-27	Clay	CH	A-7	0	100	100	95-100	95-100	60-80	40-60
	27-40	Clay loam	CL	A-6, A-7	0	100	100	90-100	70-80	37-48	16-25
	40-60	Sand	SM, SP-SM	A-2, A-3	0	90-100	90-100	40-70	5-20	---	NP
AmB: Anselmo	0-17	Loamy fine sand	SM	A-2	0	100	90-100	65-85	15-30	---	NP
	17-54	Fine sandy loam, loam.	SM, ML	A-4	0	100	100	90-100	40-65	<24	NP
	54-60	Fine sandy loam, loamy fine sand, fine sand.	SM, SP-SM	A-4, A-2	0	100	100	65-100	12-40	<20	NP
An, AnC: Anselmo	0-6	Fine sandy loam	SM, ML	A-4	0	100	100	90-100	40-65	<20	NP
	6-22	Fine sandy loam, loam.	SM, ML	A-4	0	100	100	90-100	40-65	<24	NP
	22-60	Fine sandy loam, loamy fine sand, fine sand.	SM, SP-SM	A-4, A-2	0	100	100	65-100	12-40	<20	NP
Ba: Barney	0-7	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-2, A-4	0	90-100	90-100	60-95	30-70	18-30	NP-7
	7-30	Stratified loam to fine sand.	SM, ML	A-2, A-4	0	90-100	90-100	55-80	20-60	---	NP
	30-60	Gravel, coarse sand, sand.	SP, GP, SM, GM	A-1, A-2, A-3	0	45-100	35-80	5-70	0-25	---	NP
Bo: Boel	0-7	Fine sandy loam	SM	A-4, A-2	0	100	100	85-95	20-40	---	NP
	7-60	Fine sand, loamy sand, sand.	SP, SM	A-2, A-3	0	100	100	85-95	0-25	---	NP
Bt: Brocksburg	0-15	Loam	CL, ML	A-6, A-4	0	100	100	90-100	70-90	25-40	3-15
	15-30	Clay loam, loam	CL	A-7, A-6	0	100	100	90-100	70-80	35-45	11-20
	30-60	Sand and gravel	SM, SP, SP-SM	A-1	0	85-90	40-90	30-50	3-20	---	NP
Cb, CcB: Cass	0-10	Loam	CL-ML, CL	A-4, A-6	0	95-100	95-100	85-95	60-75	25-40	5-15
	10-40	Fine sandy loam, sandy loam, very fine sandy loam.	SM, SM-SC	A-4, A-2	0	100	95-100	85-95	20-50	<20	NP-5
	40-60	Loamy fine sand, fine sand, coarse sand.	SM, SP-SM	A-2, A-3	0	95-100	95-100	50-75	5-30	---	NP
DdB, DdC: Duda	0-6	Loamy fine sand	SM, SM-SC	A-2	0	100	100	50-75	15-35	<25	NP-5
	6-25	Loamy fine sand, loamy sand.	SM, SM-SC	A-2	0	100	100	45-75	15-35	<25	NP-5
	25-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
DuB: Dunday	0-15	Loamy fine sand	SM, SM-SC	A-2	0	100	100	95-100	13-25	<25	NP-4
	15-60	Loamy fine sand, fine sand, loamy sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	50-85	5-35	<25	NP-4
DxB*: Dunday	0-15	Loamy fine sand	SM, SM-SC	A-2	0	100	100	95-100	13-25	<25	NP-4
	15-60	Loamy fine sand, fine sand, loamy sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	50-85	5-35	<25	NP-4

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
DxB*:											
Duda	0-6	Loamy fine sand	SM, SM-SC	A-2	0	100	100	50-75	15-35	<25	NP-5
	6-25	Loamy fine sand, loamy sand.	SM, SM-SC	A-2	0	100	100	45-75	15-35	<25	NP-5
	25-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Eo Els	0-7	Fine sand	SP-SM, SM	A-2, A-3	0	100	100	70-95	5-35	---	NP
	7-60	Fine sand, loamy sand.	SP-SM, SM	A-2, A-3	0	90-100	90-100	70-95	5-30	---	NP
Es Elsmere	0-12	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	100	70-100	5-35	---	NP
	12-60	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM	A-2, A-3	0	100	100	60-100	5-30	---	NP
Ho, HoC Holt	0-6	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	95-100	90-100	40-55	15-30	NP-10
	6-34	Fine sandy loam, sandy loam, loamy fine sand	SM, SC, ML, CL	A-2, A-4	0	95-100	95-100	70-100	30-55	15-30	NP-10
	34-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
HtC*, HtD*:											
Holt	0-6	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	95-100	90-100	40-55	15-30	NP-10
	6-34	Fine sandy loam, sandy loam, loamy fine sand	SM, SC, ML, CL	A-2, A-4	0	95-100	95-100	70-100	30-55	15-30	NP-10
	34-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Tassel	0-11	Fine sandy loam, loamy fine sand	ML, SM	A-4, A-2	0	95-100	90-100	70-95	30-65	15-30	NP-7
	11-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
IfD, IgB Inavale	0-6	Fine sand	SM, SP-SM, SM-SC	A-2, A-3	0	100	90-100	65-85	5-30	<25	NP-5
	6-24	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	90-100	65-85	5-30	<25	NP-5
	24-60	Fine sand, loamy fine sand, sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	100	70-90	5-30	<25	NP-5
IhB Inavale	0-5	Loamy fine sand	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	85-95	5-35	<25	NP-5
	5-15	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	90-100	65-85	5-30	<25	NP-5
	15-60	Fine sand, loamy sand, gravelly sand.	SP-SM, SM, SM-SC	A-2, A-3	0	50-100	60-100	30-90	2-30	<25	NP-5
IpB Ipage	0-6	Loamy fine sand	SM	A-2	0	100	100	50-75	15-35	---	NP
	6-60	Fine sand, loamy sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	50-70	5-30	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Ja------------------ Jansen	0-6	Fine sandy loam	SM, ML	A-4	0	95-100	90-100	80-100	40-55	20-30	NP-6
	6-22	Clay loam, loam, fine sandy loam	CL	A-6, A-7	0	95-100	90-100	80-100	50-80	30-45	10-25
	22-33	Loamy coarse sand, loamy fine sand.	SM, SP-SM	A-2, A-1	0	95-100	90-100	45-85	10-35	---	NP
	33-60	Coarse sand, gravel.	SW, SW-SM, SP, SP-SM	A-3, A-1, A-2	0	85-100	45-100	35-65	3-10	---	NP
Jn, JnC------------ Jansen	0-9	Loam------------	CL, ML	A-6, A-4	0	100	100	90-100	80-95	25-40	3-15
	9-24	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	95-100	90-100	80-100	70-80	30-45	10-25
	24-27	Loamy coarse sand, loamy sand.	SM, SP-SM	A-2, A-1	0	95-100	90-100	45-85	10-35	---	NP
	27-60	Coarse sand, gravel.	SW, SW-SM, SP, SP-SM	A-3, A-1, A-2	0	85-100	45-100	35-65	3-10	---	NP
JoB*: Jansen------------	0-12	Loam------------	CL, ML	A-6, A-4	0	100	100	90-100	80-95	25-40	3-15
	12-22	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	95-100	90-100	80-100	70-80	30-45	10-25
	22-26	Loamy coarse sand.	SM, SP-SM	A-2, A-1	0	95-100	90-100	45-85	10-35	---	NP
	26-60	Coarse sand, gravel.	SW, SW-SM, SP, SP-SM	A-3, A-1, A-2	0	85-100	45-100	35-65	3-10	---	NP
Meadin------------	0-10	Loam------------	ML	A-4	0	95-100	93-100	60-95	50-75	25-35	3-10
	10-16	Sandy loam, very gravelly loamy sand, very gravelly sand.	SM, SP-SM, GM, GP-GM	A-1, A-3, A-2	0	40-90	35-87	17-65	5-35	---	NP
	16-60	Gravelly coarse sand, very gravelly coarse sand, very gravelly sand.	SP-SM, SP, GP-GM, GP	A-1	0	30-80	18-60	9-35	1-8	---	NP
LaD---------------- Labu	0-26	Silty clay, clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-85	20-50
	26-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
LcF*: Labu---------------	0-36	Silty clay, clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-85	20-50
	36-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Sansarc------------	0-13	Silty clay, clay	CH, MH	A-7	0	100	95-100	90-100	75-100	50-100	20-65
	13-60	Unweathered bedrock.	CH, MH	A-7	0	100	95-100	90-100	85-100	50-120	20-75
Lo, Lp------------- Loup	0-11	Fine sandy loam	SM, SM-SC	A-2, A-4	0	100	100	70-85	30-45	<20	NP-6
	11-60	Fine sand, loamy sand, loamy fine sand.	SP-SM, SM	A-2, A-3	0	100	100	65-100	5-20	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
MaB, MaC----------- Manter	0-12	Loamy fine sand	SM	A-2, A-4	0	95-100	75-100	45-85	15-45	---	NP
	12-24	Fine sandy loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	95-100	75-100	50-85	30-55	15-25	NP-5
	24-48	Sandy loam, loamy fine sand.	SM	A-2, A-4, A-1	0	95-100	75-100	40-85	15-50	---	NP
	48-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
MfC---------------- Manter	0-10	Fine sandy loam	SM, ML	A-2, A-4	0	95-100	75-100	45-85	25-55	---	NP
	10-21	Fine sandy loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	95-100	75-100	50-85	30-55	15-25	NP-5
	21-60	Sandy loam, loamy sand, loamy fine sand.	SM	A-2, A-4, A-1	0	95-100	75-100	40-85	15-50	---	NP
MkG*:											
Mariaville--------	0-4	Silt loam-------	CL	A-4, A-6	0	95-100	95-100	85-100	70-95	28-35	8-15
	4-16	Loam, silty clay loam, silt loam.	CL	A-6	0	95-100	95-100	85-100	70-95	30-40	11-18
	16-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Keota-------------	0-5	Silt loam-------	ML	A-4	0	95-100	95-100	85-95	60-80	20-30	NP-5
	5-36	Silt loam, loam	ML	A-4	0	95-100	95-100	85-95	85-95	20-30	NP-5
	36-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Mm---------------- Marlake	0-8	Loamy fine sand	SM	A-2, A-4	0	100	100	50-85	15-50	<20	NP
	8-36	Fine sand, loamy sand, loamy fine sand.	SP-SM, SM	A-2, A-4, A-3	0	100	100	50-85	5-50	<20	NP
	36-60	Sand, fine sand	SM, SP-SM	A-2, A-3	0	100	100	50-80	5-35	<20	NP
MnF--------------- Meadin	0-7	Gravelly sandy loam.	SC, SM-SL	A-2, A-4	0	65-85	50-75	30-60	15-40	20-30	4-10
	7-11	Gravelly sandy loam, gravelly loamy sand, sandy loam.	SM, SP-SM, GM, GP-GM	A-1, A-2, A-3	0	40-90	35-85	17-65	5-35	15-30	NP-10
	11-60	Gravelly coarse sand, very gravelly sand, sand.	SP-SM, SP, GP-GM, GP	A-1	0	30-80	18-60	9-35	1-8	<20	NP
Mu---------------- Munjor	0-6	Fine sandy loam	SM, SC, ML, CL	A-2-4, A-4	0	100	95-100	65-100	30-75	15-30	NP-10
	6-36	Fine sandy loam, silt loam, loamy very fine sand.	SM, SC, ML, CL	A-2-4, A-4	0	100	95-100	65-100	30-65	15-30	3-10
	36-60	Loamy sand, sand, loamy fine sand.	SM, SP-SM	A-2-4, A-3, A-4	0	98-100	95-100	55-90	5-40	---	NP
OaB--------------- O'Neill	0-7	Loamy fine sand	SM, ML, SC, CL	A-2, A-4	0	95-100	95-100	70-85	30-55	<25	NP-10
	7-30	Fine sandy loam, sandy loam.	SC, SM-SC	A-2, A-4	0	95-100	95-100	60-75	30-50	<30	4-10
	30-60	Stratified sand to gravelly sand.	SP, SP-SM	A-1	0	70-100	50-90	25-35	0-5	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
Oe, OeC, OeD: O'Neill	0-6	Fine sandy loam	SM, ML, SC, CL	A-2, A-4	0	95-100	95-100	70-85	30-55	<25	NP-10
	6-24	Fine sandy loam, sandy loam.	SC, SM-SC	A-2, A-4	0	95-100	95-100	60-75	30-50	<30	4-10
	24-60	Stratified sand to gravelly sand.	SP, SP-SM	A-1	0	70-100	50-90	25-35	0-5	---	NP
OhB*:											
O'Neill	0-7	Fine sandy loam	SM, ML, SC, CL	A-2, A-4	0	95-100	95-100	70-85	30-55	<25	NP-10
	7-26	Fine sandy loam, sandy loam.	SC, SM-SC	A-2, A-4	0	95-100	95-100	60-75	30-50	<30	4-10
	26-60	Stratified sand to gravelly sand.	SP, SP-SM	A-1	0	70-100	50-90	25-35	0-5	---	NP
Meadin	0-7	Fine sandy loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	95-100	93-100	60-80	30-55	<20	NP-5
	7-12	Sandy loam, very gravelly loamy sand, gravelly sandy loam.	SM, SP-SM, GM, GP-GM	A-1, A-3, A-2	0	40-90	35-87	17-65	5-35	---	NP
	12-60	Gravelly coarse sand, very gravelly coarse sand.	SP-SM, SP, GP-GM, GP	A-1	0	30-80	18-60	9-35	1-8	---	NP
OkD*:											
O'Neill	0-6	Fine sandy loam	SM, ML, SC, CL	A-2, A-4	0	95-100	95-100	70-85	30-55	<25	NP-10
	6-21	Fine sandy loam, sandy loam.	SC, SM-SC	A-2, A-4	0	95-100	95-100	60-75	30-50	<30	4-10
	21-60	Stratified sand to gravelly sand.	SP, SP-SM	A-1	0	70-100	50-90	25-35	0-5	---	NP
Valentine	0-5	Fine sand	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	---	NP
	5-60	Fine sand, loamy fine sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	95-100	2-20	---	NP
On: Onita	0-16	Silt loam	ML, CL	A-4, A-6	0	100	95-100	90-100	70-100	30-40	5-15
	16-36	Silty clay loam, clay loam, silty clay.	CL, CH, ML, MH	A-6, A-7	0	100	95-100	90-100	75-100	35-60	10-35
	36-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-6, A-7	0-5	95-100	95-100	85-100	65-100	30-55	10-30
Or*:											
Ord	0-24	Fine sandy loam, loam.	ML, SM	A-2, A-4	0	95-100	95-100	70-98	30-80	20-35	NP-10
	24-36	Fine sandy loam, loamy fine sand.	ML, SM	A-2, A-4	0	95-100	95-100	70-90	30-55	20-35	NP-10
	36-60	Stratified sand to fine sandy loam.	SM, SP-SM, SC, SM-SC	A-2, A-4, A-3	0	95-100	95-100	50-95	5-50	10-25	NP-10
Loup	0-14	Fine sandy loam	SM, SM-SC	A-2, A-4	0	100	100	70-85	30-45	<20	NP-6
	14-60	Fine sand, loamy sand, sand.	SP-SM, SM	A-2, A-3	0	100	100	65-100	5-20	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
Pf------------------ Paka	0-24	Fine sandy loam	SM	A-4	0	100	100	70-85	40-50	---	NP
	24-40	Silty clay loam, clay loam, silt loam.	CL	A-6	0	100	100	95-100	75-95	30-40	15-25
	40-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Ph, PhB------------ Paka	0-14	Loam------------	CL	A-4, A-6	0	100	100	95-100	65-100	20-35	8-18
	14-25	Silty clay loam, clay loam, silt loam.	CL	A-6	0	100	100	95-100	75-95	30-40	15-25
	25-41	Silt loam, very fine sandy loam.	CL	A-4, A-6	0	100	100	95-100	75-95	25-40	8-20
	41-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
PmC*, PmF*:											
Paka---------------	0-14	Loam------------	CL	A-4, A-6	0	100	100	95-100	65-100	20-35	8-18
	14-25	Silty clay loam, clay loam, silt loam.	CL	A-6	0	100	100	95-100	75-95	30-40	15-25
	25-41	Silt loam, very fine sandy loam.	CL	A-4, A-6	0	100	100	95-100	75-95	25-40	8-20
	41-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Mariaville---------	0-4	Loam------------	CL	A-4, A-6	0	95-100	95-100	85-100	70-95	28-35	8-15
	4-16	Loam, silty clay loam, silt loam.	CL	A-6	0	95-100	95-100	85-100	70-95	30-40	11-18
	16-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
RaB---------------- Ree	0-13	Loam------------	CL, CL-ML	A-4, A-6	0	100	95-100	80-100	70-95	25-40	5-15
	13-54	Clay loam, sandy clay loam, silty clay loam.	CL	A-6, A-7	0	100	90-100	70-100	65-85	30-45	10-20
	54-60	Sandy loam, loam, loamy sand.	CL, ML SC, SL	A-4, A-6	0	100	85-100	50-100	35-85	15-40	NP-20
Rb----------------- Ree	0-25	Loam------------	CL, CL-ML	A-4, A-6	0	100	100	85-95	60-70	25-35	5-15
	25-40	Sandy clay loam	CL, SC	A-4, A-6	0	100	100	80-90	35-55	30-40	10-20
	40-54	Shaley clay, clay.	CH, MH	A-4, A-6	0	100	95-100	90-100	85-95	55-85	20-50
	54-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
ReC---------------- Reliance	0-11	Silt loam-------	CL, CL-ML, ML	A-4, A-6	0	100	100	95-100	70-100	20-40	5-15
	11-27	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	95-100	85-100	35-60	15-30
	27-48	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	70-100	30-50	10-25
	48-60	Stratified sand, gravelly sand.	SP, SP-SM	A-1	0	70-100	50-90	25-35	0-5	---	NP
RoD*, RoF*:											
Ronson-------------	0-13	Fine sandy loam	ML, SM, SC	A-2, A-4	0	100	100	60-85	30-55	15-30	NP-10
	13-25	Fine sandy loam, sandy loam, loamy sand.	ML, SM, SC	A-2, A-4	0	100	100	60-85	30-55	10-30	NP-10
	25-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
RoD*, RoF*:											
Anselmo-----------	0-6	Fine sandy loam	SM, ML	A-4	0	100	100	90-100	40-65	<20	NP
	6-22	Fine sandy loam, loam.	SM, ML	A-4	0	100	100	90-100	40-65	<24	NP
	22-60	Fine sandy loam, loamy fine sand, fine sand.	SM, SP-SM	A-4, A-2	0	100	100	65-100	12-40	<20	NP
RtB*:											
Ronson------------	0-13	Fine sandy loam	ML, SM, SC	A-2, A-4	0	100	100	60-85	30-55	15-30	NP-10
	13-25	Fine sandy loam, sandy loam, loamy sand.	ML, SM, SC	A-2, A-4	0	100	100	60-85	30-55	15-30	NP-10
	25-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Tassel------------	0-17	Fine sandy loam	ML, SM	A-4, A-2	0	95-100	90-100	70-95	30-65	20-35	NP-7
	17-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
SaG---------------- Sansarc	0-14	Silty clay, clay	CH, MH	A-7	0	100	95-100	90-100	75-100	50-100	20-65
	14-60	Unweathered bedrock.	CH, MH	A-7	0	100	95-100	90-100	85-100	50-120	20-75
ScF---------------- Schamber	0-4	Gravelly sandy loam.	SM, SW-SM, GM, GW-GM	A-2, A-1	0-5	55-90	40-75	30-60	10-35	<25	NP-5
	4-60	Gravelly sand, very gravelly sandy loam, gravelly loamy sand.	SW, SW-SM, GW, GW-GM	A-1	0-15	30-60	15-35	5-20	0-10	<25	NP-5
SmF*:											
Simeon------------	0-12	Loamy fine sand	SM, SP-SM	A-2	0	95-100	90-100	51-80	10-30	---	NP
	12-60	Sand, coarse sand, loamy coarse sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	90-100	75-100	40-80	2-15	---	NP
Manter------------	0-6	Loamy fine sand	SM	A-2, A-4	0	95-100	75-100	45-85	15-45	---	NP
	6-26	Fine sandy loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	95-100	75-100	50-85	30-55	15-25	NP-5
	26-41	Sandy loam, loamy sand, fine sandy loam.	SM	A-2, A-4, A-1	0	95-100	75-100	40-85	15-50	---	NP
	41-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Ronson------------	0-13	Fine sandy loam	ML, SM, SC	A-2, A-4	0	100	100	60-85	30-55	15-30	NP-10
	13-25	Fine sandy loam, sandy loam, loamy sand.	ML, SM, SC	A-2, A-4	0	100	100	60-85	30-55	15-30	NP-10
	25-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
SvF2*:											
Simeon------------	0-8	Fine sand-------	SM, SP-SM	A-2	0	95-100	90-100	51-80	10-30	---	NP
	8-60	Sand, coarse sand, loamy coarse sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	90-100	75-100	40-80	2-15	---	NP
Valentine---------	0-7	Fine sand-------	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	---	NP
	7-60	Fine sand, loamy fine sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	95-100	2-20	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
SwB*:											
Simeon------------	0-18	Loamy sand------	SM, SP-SM	A-2	0	95-100	90-100	51-80	10-30	---	NP
	18-60	Sand, coarse sand, gravelly coarse sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	90-100	75-100	40-80	2-15	---	NP
Valentine---------	0-6	Loamy sand------	SM, SP-SM, SP	A-2, A-3	0	100	100	95-100	2-35	---	NP
	6-60	Fine sand, loamy fine sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	95-100	2-20	---	NP
TaF---------------- Tassel	0-13	Loamy fine sand, fine sandy loam	SM	A-2, A-4	0	95-100	90-100	50-85	15-50	---	NP
	13-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
TdE*:											
Tassel------------	0-11	Fine sandy loam	ML, SM	A-4, A-2	0	95-100	90-100	70-95	30-65	20-35	NP-7
	11-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Duda--------------	0-6	Loamy fine sand	SM, SM-SC	A-2	0	100	100	50-75	15-35	<25	NP-5
	6-39	Loamy fine sand, loamy sand, fine sand.	SM, SM-SC	A-2	0	100	100	45-75	15-35	<25	NP-5
	39-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
TrG*:											
Tassel------------	0-18	Loamy fine sand, fine sandy loam	SM	A-2	0	95-100	90-100	50-75	15-30	---	NP
	18-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Ronson------------	0-9	Fine sandy loam	ML, SM, SC	A-2, A-4	0	100	100	60-85	30-55	15-30	NP-10
	9-35	Fine sandy loam, sandy loam.	ML, SM, SC	A-2, A-4	0	100	100	60-85	30-55	15-30	NP-10
	35-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Duda--------------	0-14	Sandy loam------	SM, SM-SC	A-4, A-2	0	100	100	60-70	30-40	20-30	NP-7
	14-36	Loamy fine sand, loamy sand, fine sand.	SM, SM-SC	A-2	0	100	100	45-75	15-35	<25	NP-5
	36-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Tu----------------- Tuthill	0-11	Fine sandy loam	ML, SM	A-4	0	100	100	85-100	40-55	20-35	NP-10
	11-27	Sandy clay loam, fine sandy loam, loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	100	100	70-90	35-70	25-40	5-15
	27-48	Loamy sand, loamy fine sand, fine sand.	SM, SM-SC	A-2	0	100	95-100	50-85	15-30	<25	NP-5
	48-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
VaF, VaG----------- Valentine	0-7	Fine sand-------	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	---	NP
	7-60	Fine sand, loamy fine sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	95-100	2-20	---	NP
VbD---------------- Valentine	0-5	Loamy fine sand	SM, SP-SM, SP	A-2, A-3	0	100	100	95-100	2-35	---	NP
	5-60	Fine sand, loamy fine sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	95-100	2-20	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
VcF*:											
Valentine---------	0-9	Fine sand-------	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	---	NP
	9-60	Fine sand, loamy fine sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	95-100	2-20	---	NP
Tassel------------	0-13	Fine sandy loam, loam.	ML, SM	A-4, A-2	0	95-100	90-100	70-95	30-70	20-35	NP-7
	13-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
VdC*:											
Valentine---------	0-5	Loamy fine sand	SM, SP-SM, SP	A-2, A-3	0	100	100	95-100	2-35	---	NP
	5-60	Fine sand, loamy fine sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	95-100	2-20	---	NP
Valentine, clayey substratum	0-5	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	100	95-100	5-35	<20	NP
	5-40	Fine sand, loamy fine sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-25	<20	NP
	40-60	Clay, shaly clay	CH	A-7	0	100	95-100	90-100	70-90	50-70	30-45
Wewela------------	0-7	Loamy fine sand	SM, SM-SC	A-2	0	100	100	50-75	20-35	<25	NP-5
	7-22	Clay loam, sandy loam.	SC, CL, SM	A-6, A-4	0	100	100	60-100	35-75	25-40	NP-15
	22-26	Clay, shaly clay	CH, MH	A-7	0	100	95-100	90-100	85-100	55-85	20-50
	26-60	Unweathered bedrock.	CH, MH	A-7	0	100	95-100	90-100	85-100	50-100	20-65
VdF*:											
Valentine---------	0-8	Loamy fine sand	SM, SP-SM, SP	A-2, A-3	0	100	100	95-100	2-35	---	NP
	8-60	Fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	95-100	2-20	---	NP
Valentine, clayey substratum	0-9	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	100	95-100	5-35	<20	NP
	9-40	Fine sand, loamy fine sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-25	<20	NP
	40-60	Clay, shaly clay	CH	A-7	0	100	95-100	90-100	70-90	50-70	30-45
Wewela------------	0-18	Loamy fine sand	SM, SM-SC	A-2	0	100	100	50-75	20-35	<25	NP-5
	18-23	Sandy clay loam	SC, CL	A-6	0	100	100	60-100	35-55	30-40	10-20
	23-40	Clay, shaly clay	CH, MH	A-7	0	100	95-100	90-100	85-100	55-85	20-50
	40-60	Unweathered bedrock.	CH, MH	A-7	0	100	95-100	90-100	85-100	50-100	20-65
Ve, VeB, VeC------- Verdel	0-18	Silty clay loam	CL, CH	A-6, A-7	0	100	95-100	90-100	85-100	35-55	20-30
	18-60	Silty clay, clay	CH	A-7	0	100	95-100	95-100	85-100	50-70	27-45
Vo---------------- Vetal	0-36	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	100	85-100	40-55	20-30	NP-10
	36-60	Fine sandy loam, very fine sandy loam, loamy fine sand.	SM, SC, ML, CL	A-4, A-2	0	100	100	60-95	30-65	20-35	NP-12

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Vt, VtB, VtC-------- Vetal	0-34	Loam-------------	ML, CL, CL-ML	A-4	0	100	100	90-100	50-60	25-35	5-12
	34-54	Fine sandy loam, very fine sandy loam, loam.	SM, SC, ML, CL	A-4, A-2	0	100	100	60-95	30-65	20-35	NP-12
	54-60	Loamy fine sand, fine sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-25	<20	NP
WeB, WeC------------ Wewela	0-8	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	100	100	70-85	40-55	15-30	NP-10
	8-16	Sandy clay loam	SC, CL	A-6	0	100	100	60-100	35-55	30-40	10-20
	16-36	Clay, shaly clay	CH, MH	A-7	0	100	95-100	90-100	85-100	55-85	20-50
	36-60	Unweathered bedrock.	CH, MH	A-7	0	100	95-100	90-100	85-100	50-100	20-65

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH				
Ab----------------- Albaton Variant	0-27	0.06-0.2	0.11-0.13	7.9-8.4	High----------	0.32	4	4
	27-40	0.2-0.6	0.15-0.17	7.9-8.4	Moderate------	0.32		
	40-60	6.0-20	0.05-0.07	7.9-8.4	Low-----------	0.15		
AmB---------------- Anselmo	0-17	>6.0	0.10-0.12	6.1-7.8	Low-----------	0.20	5	2
	17-54	2.0-6.0	0.15-0.19	6.6-7.8	Low-----------	0.20		
	54-60	2.0-6.0	0.08-0.16	6.6-8.4	Low-----------	0.20		
An, AnC------------ Anselmo	0-6	0.6-6.0	0.16-0.22	6.1-7.8	Low-----------	0.20	5	3
	6-22	2.0-6.0	0.15-0.19	6.6-7.8	Low-----------	0.20		
	22-60	2.0-6.0	0.08-0.16	6.6-8.4	Low-----------	0.20		
Ba----------------- Barney	0-7	0.6-20	0.07-0.17	6.6-8.4	Low-----------	0.17	2	3
	7-30	2.0-20	0.09-0.14	7.4-8.4	Low-----------	0.17		
	30-60	>20	0.02-0.04	6.6-7.8	Low-----------	0.10		
Bo----------------- Boel	0-7	2.0-6.0	0.16-0.18	6.6-8.4	Low-----------	0.20	5	3
	7-60	6.0-20	0.05-0.07	6.6-8.4	Low-----------	0.20		
Bt----------------- Brocksburg	0-15	0.6-2.0	0.20-0.24	6.1-7.3	Low-----------	0.28	5	5
	15-30	0.6-2.0	0.15-0.19	6.6-7.8	Moderate------	0.28		
	30-60	>20	0.02-0.04	6.6-7.8	Low-----------	0.10		
Cb, CcB------------ Cass	0-10	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.28	5	5
	10-40	2.0-6.0	0.15-0.17	6.1-8.4	Low-----------	0.20		
	40-60	6.0-20	0.08-0.10	6.1-8.4	Low-----------	0.20		
DdB, DdC----------- Duda	0-6	2.0-20	0.10-0.12	6.1-7.3	Low-----------	0.17	4	2
	6-25	2.0-20	0.08-0.10	6.1-7.8	Low-----------	0.17		
	25-60	---	---	---	--------------	---		
DuB---------------- Dunday	0-15	2.0-6.0	0.10-0.12	6.1-7.3	Low-----------	0.17	5	2
	15-60	2.0-20	0.09-0.11	6.1-7.8	Low-----------	0.17		
DxB*:								
Dunday-------------	0-15	2.0-6.0	0.10-0.12	6.1-7.3	Low-----------	0.17	5	2
	15-60	2.0-20	0.09-0.11	6.1-7.8	Low-----------	0.17		
Duda---------------	0-6	2.0-20	0.10-0.12	6.1-7.3	Low-----------	0.17	4	2
	6-25	2.0-20	0.08-0.10	6.1-7.8	Low-----------	0.17		
	25-60	---	---	---	--------------	---		
Eo----------------- Els	0-7	6.0-20	0.07-0.09	6.6-7.8	Low-----------	0.17	5	1
	7-60	6.0-20	0.06-0.08	6.6-7.8	Low-----------	0.17		
Es----------------- Elsmere	0-12	6.0-20	0.10-0.12	5.6-7.8	Low-----------	0.17	5	2
	12-60	6.0-20	0.06-0.08	5.6-7.8	Low-----------	0.17		
Ho, HoC------------ Holt	0-6	0.6-6.0	0.14-0.17	6.6-7.8	Low-----------	0.20	4	3
	6-34	0.6-6.0	0.10-0.16	6.6-7.8	Low-----------	0.20		
	34-60	---	---	---	--------------	---		
HtC*, HtD*:								
Holt---------------	0-6	0.6-6.0	0.14-0.17	6.6-7.8	Low-----------	0.20	4	3
	6-34	0.6-6.0	0.10-0.16	6.6-7.8	Low-----------	0.20		
	34-60	---	---	---	--------------	---		
Tassel-------------	0-11	2.0-6.0	0.16-0.18	7.4-8.4	Low-----------	0.24	2	3
	11-60	---	---	---	--------------	---		
IfD, IgB----------- Inavale	0-6	6.0-20	0.07-0.09	5.6-7.3	Low-----------	0.17	5	1
	6-24	6.0-20	0.09-0.11	6.6-8.4	Low-----------	0.17		
	24-60	6.0-20	0.05-0.07	6.6-8.4	Low-----------	0.17		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH				
IhB---------------- Inavale	0-5	>6.0	0.10-0.12	5.6-7.3	Low------------	0.17	5	2
	5-15	6.0-20	0.09-0.11	6.6-8.4	Low------------	0.17		
	15-60	6.0-20	0.05-0.07	6.6-8.4	Low------------	0.17		
IpB---------------- Ipage	0-6	6.0-20	0.10-0.12	6.1-7.3	Low------------	0.17	5	2
	6-60	6.0-20	0.06-0.10	6.1-7.3	Low------------	0.17		
Ja----------------- Jansen	0-6	2.0-6.0	0.13-0.18	5.1-7.3	Low------------	0.20	4	3
	6-22	0.6-2.0	0.15-0.19	5.1-7.3	Moderate------	0.32		
	22-33	6.0-20	0.06-0.11	5.1-7.3	Low------------	0.10		
	33-60	>20	0.02-0.04	5.1-7.3	Low------------	0.10		
Jn, JnC------------ Jansen	0-9	0.6-2.0	0.20-0.24	5.1-7.3	Low------------	0.32	4	6
	9-24	0.6-2.0	0.15-0.19	5.1-7.3	Moderate------	0.32		
	24-27	6.0-20	0.06-0.11	5.1-7.3	Low------------	0.10		
	27-60	>20	0.02-0.04	5.1-7.3	Low------------	0.10		
JoB*:								
Jansen------------	0-12	0.6-2.0	0.20-0.24	5.1-7.3	Low------------	0.32	4	6
	12-22	0.6-2.0	0.15-0.19	5.1-7.3	Moderate------	0.32		
	22-26	6.0-20	0.06-0.11	5.1-7.3	Low------------	0.10		
	26-60	>20	0.02-0.04	5.1-7.3	Low------------	0.10		
Meadin------------	0-10	0.6-2.0	0.20-0.22	5.1-7.3	Low------------	0.28	3	5
	10-16	6.0-20	0.09-0.11	5.1-7.3	Low------------	0.10		
	16-60	>20	0.05-0.07	6.1-7.3	Low------------	0.10		
LaD---------------- Labu	0-26	0.06-0.2	0.08-0.14	7.4-8.4	High-----------	0.32	3	4
	26-60	---	---	---	---------------	---		
LcF*:								
Labu--------------	0-36	0.06-0.2	0.08-0.14	7.4-8.4	High-----------	0.32	3	4
	36-60	---	---	---	---------------	---		
Sansarc-----------	0-13	0.06-0.2	0.08-0.12	6.6-8.4	High-----------	0.37	2	8
	13-60	---	---	5.6-8.4	High-----------	---		
Lo, Lp------------- Loup	0-11	0.6-2.0	0.16-0.18	6.6-8.4	Low------------	0.17	5	3
	11-60	6.0-20	0.06-0.08	7.4-8.4	Low------------	0.17		
MaB, MaC----------- Manter	0-12	6.0-20	0.08-0.12	6.6-7.8	Low------------	0.10	5	2
	12-24	2.0-6.0	0.11-0.14	6.6-7.8	Low------------	0.15		
	24-48	6.0-20	0.08-0.14	7.9-8.4	Low------------	0.15		
	48-60	---	---	---	---------------	---		
MfC---------------- Manter	0-10	2.0-6.0	0.12-0.16	6.6-7.8	Low------------	0.15	5	3
	10-21	2.0-6.0	0.11-0.14	6.6-7.8	Low------------	0.15		
	21-60	6.0-20	0.08-0.14	7.9-8.4	Low------------	0.15		
MkG*:								
Mariaville--------	0-4	0.6-2.0	0.20-0.24	6.6-7.8	Low------------	0.37	2	6
	4-16	0.6-2.0	0.17-0.22	7.4-8.4	Low------------	0.37		
	16-60	---	---	---	---------------	---		
Keota-------------	0-5	0.6-2.0	0.16-0.18	7.4-7.8	Low------------	0.37	2	4L
	5-36	0.6-2.0	0.14-0.16	7.9-8.4	Low------------	0.43		
	36-60	---	---	---	---------------	---		
Mm----------------- Marlake	0-8	6.0-20	0.10-0.14	6.6-8.4	Low------------	0.17	2	2
	8-36	6.0-20	0.06-0.11	6.6-8.4	Low------------	0.17		
	36-60	6.0-20	0.05-0.07	6.6-7.8	Low------------	0.17		
MnF---------------- Meadin	0-7	0.6-2.0	0.13-0.16	5.1-7.3	Low------------	0.10	2	8
	7-11	6.0-20	0.09-0.11	5.1-7.3	Low------------	0.10		
	11-60	>20	0.05-0.07	6.1-7.3	Low------------	0.10		
Mu----------------- Munjor	0-6	2.0-6.0	0.14-0.20	7.4-8.4	Low------------	0.24	5	3
	6-36	2.0-6.0	0.13-0.18	7.4-8.4	Low------------	0.24		
	36-60	6.0-20	0.06-0.09	7.4-8.4	Low------------	0.24		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea- bility	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH				
OaB---------------- O'Neill	0-7	2.0-20	0.10-0.18	6.1-6.5	Low------------	0.20	4	3
	7-30	2.0-6.0	0.15-0.17	6.6-7.3	Low------------	0.20		
	30-60	>20	0.02-0.04	6.6-7.3	Low------------	0.10		
Oe, OeC, OeD------ O'Neill	0-6	2.0-20	0.10-0.18	6.1-6.5	Low------------	0.20	4	3
	6-24	2.0-6.0	0.15-0.17	6.6-7.3	Low------------	0.20		
	24-60	>20	0.02-0.04	6.6-7.3	Low------------	0.10		
OhB*:								
O'Neill----------	0-7	2.0-20	0.10-0.18	6.1-6.5	Low------------	0.20	4	3
	7-26	2.0-6.0	0.15-0.17	6.6-7.3	Low------------	0.20		
	26-60	>20	0.02-0.04	6.6-7.3	Low------------	0.10		
Meadin-----------	0-7	0.6-2.0	0.13-0.18	5.1-7.3	Low------------	0.20	3-2	3
	7-12	6.0-20	0.09-0.11	5.1-7.3	Low------------	0.10		
	12-60	>20	0.05-0.07	6.1-7.3	Low------------	0.10		
OkD*:								
O'Neill----------	0-6	2.0-20	0.10-0.18	6.1-6.5	Low------------	0.20	4	3
	6-21	2.0-6.0	0.15-0.17	6.6-7.3	Low------------	0.20		
	21-60	>20	0.02-0.04	6.6-7.3	Low------------	0.10		
Valentine--------	0-5	6.0-20	0.06-0.11	6.1-7.3	Low------------	0.15	5	1
	5-60	6.0-20	0.06-0.08	6.1-7.3	Low------------	0.15		
On---------------- Onita	0-16	0.6-2.0	0.19-0.22	5.6-7.3	Moderate------	0.28	5	6
	16-36	0.2-0.6	0.11-0.17	6.1-7.3	High----------	0.28		
	36-60	0.2-0.6	0.17-0.20	7.4-8.4	High----------	0.43		
Or*:								
Ord--------------	0-24	0.6-6.0	0.16-0.24	6.1-8.4	Low------------	0.20	5	3
	24-36	2.0-6.0	0.15-0.17	6.6-8.4	Low------------	0.20		
	36-60	2.0-20	0.02-0.04	6.6-8.4	Low------------	0.20		
Loup-------------	0-14	0.6-2.0	0.16-0.18	6.6-8.4	Low------------	0.17	5	3
	14-60	6.0-20	0.06-0.08	7.4-8.4	Low------------	0.17		
Pf---------------- Paka	0-24	2.0-6.0	0.16-0.18	6.6-7.3	Low------------	0.24	5	3
	24-40	0.6-2.0	0.18-0.20	7.4-8.4	Moderate------	0.32		
	40-60	---	---	---	---------------	---		
Ph, PhB----------- Paka	0-14	0.6-2.0	0.22-0.24	6.6-7.3	Moderate------	0.32	5	6
	14-25	0.6-2.0	0.18-0.20	7.4-8.4	Moderate------	0.32		
	25-41	0.6-2.0	0.20-0.22	7.4-8.4	Moderate------	0.32		
	41-60	---	---	---	---------------	---		
PmC*, PmF*:								
Paka-------------	0-14	0.6-2.0	0.22-0.24	6.6-7.3	Moderate------	0.32	5	6
	14-25	0.6-2.0	0.18-0.20	7.4-8.4	Moderate------	0.32		
	25-41	0.6-2.0	0.20-0.22	7.4-8.4	Moderate------	0.32		
	41-60	---	---	---	---------------	---		
Mariaville-------	0-4	0.6-2.0	0.20-0.24	6.6-7.8	Low------------	0.37	2	6
	4-16	0.6-2.0	0.17-0.22	7.4-8.4	Low------------	0.37		
	16-60	---	---	---	---------------	---		
RaB--------------- Ree	0-13	0.6-2.0	0.18-0.22	6.1-7.3	Moderate------	0.28	5	6
	13-54	0.6-2.0	0.17-0.22	6.6-8.4	Moderate------	0.28		
	54-60	2.0-6.0	0.09-0.20	7.4-8.4	Moderate------	0.28		
Rb---------------- Ree	0-25	0.6-2.0	0.18-0.22	6.1-7.3	Moderate------	0.28	5	6
	25-40	0.6-2.0	0.18-0.22	6.1-7.8	Moderate------	0.28		
	40-54	0.06-0.02	0.18-0.20	6.6-8.4	Moderate------	0.28		
	54-60	---	---	---	---------------	---		
ReC--------------- Reliance	0-11	0.6-2.0	0.19-0.22	6.1-7.3	Moderate------	0.32	5	6
	11-27	0.2-0.6	0.11-0.19	6.6-8.4	High----------	0.32		
	27-48	0.2-2.0	0.14-0.20	7.4-8.4	Moderate------	0.32		
	48-60	>20	0.02-0.04	6.6-7.3	Low------------	0.10		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH				
RoD*, RoF*:								
Ronson	0-13	2.0-6.0	0.11-0.17	6.6-8.4	Low	0.20	4	3
	13-25	2.0-6.0	0.09-0.15	7.4-8.4	Low	0.20		
	25-60	---	---	7.9-8.4	Low	---		
Anselmo	0-6	0.6-6.0	0.16-0.22	6.1-7.8	Low	0.20	5	3
	6-22	2.0-6.0	0.15-0.19	6.6-7.8	Low	0.20		
	22-60	2.0-6.0	0.08-0.16	6.6-8.4	Low	0.20		
RtB*:								
Ronson	0-13	2.0-6.0	0.11-0.17	6.6-8.4	Low	0.20	4	3
	13-25	2.0-6.0	0.09-0.15	7.4-8.4	Low	0.20		
	25-60	---	---	7.9-8.4	Low	---		
Tassel	0-17	2.0-6.0	0.16-0.18	7.4-8.4	Low	0.24	2	3
	17-60	---	---	---	---	---		
SaG Sansarc	0-14	0.06-0.2	0.08-0.12	6.6-8.4	High	0.37	2	8
	14-60	---	---	5.6-8.4	High	---		
ScF Schamber	0-4	>6.0	0.03-0.06	6.6-8.4	Low	0.10	2	8
	4-60	>6.0	0.03-0.06	7.4-8.4	Low	0.10		
SmF*:								
Simeon	0-12	6.0-20	0.06-0.12	6.1-7.3	Low	0.15	5	2
	12-60	6.0-20	0.05-0.10	6.1-7.3	Low	0.15		
Manter	0-6	6.0-20	0.08-0.12	6.6-7.8	Low	0.10	5	2
	6-26	2.0-6.0	0.11-0.14	6.6-7.8	Low	0.15		
	26-41	6.0-20	0.08-0.14	7.9-8.4	Low	0.15		
	41-60	---	---	---	---	---		
Ronson	0-13	2.0-6.0	0.11-0.17	6.6-8.4	Low	0.20	4	3
	13-25	2.0-6.0	0.09-0.15	7.4-8.4	Low	0.20		
	25-60	---	---	7.9-8.4	Low	---		
SvF2*:								
Simeon	0-8	6.0-20	0.06-0.12	6.1-7.3	Low	0.15	5	2
	8-60	6.0-20	0.05-0.10	6.1-7.3	Low	0.15		
Valentine	0-7	6.0-20	0.06-0.11	6.1-7.3	Low	0.15	5	1
	7-60	6.0-20	0.06-0.08	6.1-7.3	Low	0.15		
SwB*:								
Simeon	0-18	6.0-20	0.06-0.12	6.1-7.3	Low	0.15	5	2
	18-60	6.0-20	0.05-0.10	6.1-7.3	Low	0.15		
Valentine	0-6	6.0-20	0.08-0.11	6.1-7.3	Low	0.15	5	2
	6-60	6.0-20	0.06-0.08	6.1-7.3	Low	0.15		
TaF Tassel	0-13	6.0-20	0.10-0.12	7.4-8.4	Low	0.17	2	2
	13-18	---	---	---	---	---		
TdE*:								
Tassel	0-11	2.0-6.0	0.16-0.18	7.4-8.4	Low	0.24	2	3
	11-60	---	---	---	---	---		
Duda	0-6	2.0-20	0.10-0.12	6.1-7.3	Low	0.17	4	2
	6-39	2.0-20	0.08-0.10	6.1-7.8	Low	0.17		
	39-60	---	---	---	---	---		
TrG*:								
Tassel	0-18	6.0-20	0.10-0.12	7.4-8.4	Low	0.17	2	2
	18-60	---	---	---	---	---		
Ronson	0-9	2.0-6.0	0.11-0.17	6.6-8.4	Low	0.20	4	3
	9-35	2.0-6.0	0.09-0.15	7.4-8.4	Low	0.20		
	35-60	---	---	7.9-8.4	Low	---		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea- bility	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH				
TrG*:								
Duda	0-14	2.0-6.0	0.11-0.15	6.1-7.3	Low	0.17	4	3
	14-36	2.0-20	0.08-0.10	6.1-7.8	Low	0.17		
	36-60	---	---	---	---	---		
Tu Tuthill	0-11	0.6-6.0	0.14-0.17	6.1-7.8	Low	0.20	4	3
	11-27	0.6-2.0	0.09-0.18	6.1-7.8	Moderate	0.20		
	27-48	6.0-20	0.06-0.10	7.4-8.4	Low	0.20		
	48-60	---	---	---	---	---		
VaF, VaG Valentine	0-7	6.0-20	0.06-0.11	6.1-7.3	Low	0.15	5	1
	7-60	6.0-20	0.06-0.08	6.1-7.3	Low	0.15		
VbD Valentine	0-5	6.0-20	0.08-0.11	6.1-7.3	Low	0.15	5	2
	5-60	6.0-20	0.06-0.08	6.1-7.3	Low	0.15		
VcF*:								
Valentine	0-9	6.0-20	0.06-0.11	6.1-7.3	Low	0.15	5	1
	9-60	6.0-20	0.06-0.08	6.1-7.3	Low	0.15		
Tassel	0-13	2.0-6.0	0.16-0.18	7.4-8.4	Low	0.24	2	3
	13-60	---	---	---	---	---		
VdC*:								
Valentine	0-5	6.0-20	0.08-0.11	6.1-7.3	Low	0.15	5	2
	5-60	6.0-20	0.06-0.08	6.1-7.3	Low	0.15		
Valentine, clayey substratum	0-5	6.0-20	0.08-0.11	6.6-7.3	Low	0.15	5	2
	5-40	6.0-20	0.06-0.08	6.6-7.3	Low	0.15		
	40-60	0.06-0.2	0.08-0.14	7.4-8.4	High	0.32		
Wewela	0-7	2.0-6.0	0.10-0.12	6.1-7.3	Low	0.17	4	2
	7-22	0.6-2.0	0.16-0.18	6.1-7.3	Moderate	0.32		
	22-26	0.06-0.2	0.08-0.12	6.1-7.8	High	0.32		
	26-60	<0.06	---	6.6-8.4	High	---		
VdF*:								
Valentine	0-8	6.0-20	0.08-0.11	6.1-7.3	Low	0.15	5	2
	8-60	6.0-20	0.06-0.08	6.1-7.3	Low	0.15		
Valentine, clayey substratum	0-9	6.0-20	0.08-0.11	6.6-7.3	Low	0.15	5	2
	9-40	6.0-20	0.06-0.08	6.6-7.3	Low	0.15		
	40-60	0.06-0.2	0.08-0.14	7.4-8.4	High	0.32		
Wewela	0-18	2.0-6.0	0.10-0.12	6.1-7.3	Low	0.17	4	2
	18-23	0.6-2.0	0.16-0.18	6.1-7.3	Moderate	0.32		
	23-40	0.06-0.2	0.08-0.12	6.1-7.8	High	0.32		
	40-60	<0.06	---	6.6-8.4	High	---		
Ve, VeB, VeC Verdel	0-18	0.2-0.6	0.21-0.23	6.1-7.3	High	0.32	5	7
	18-60	<0.2	0.09-0.14	6.6-9.0	High	0.32		
Vo Vetal	0-36	2.0-6.0	0.14-0.17	6.6-7.8	Low	0.20	5	3
	36-60	2.0-6.0	0.11-0.19	6.6-7.8	Low	0.20		
	36-60	2.0-6.0	0.10-0.17	7.4-8.4	Low	0.20		
Vt, VtB, VtC Vetal	0-34	2.0-6.0	0.17-0.19	6.6-7.8	Low	0.28	5	5
	34-54	2.0-6.0	0.11-0.19	6.6-7.8	Low	0.20		
	54-60	2.0-6.0	0.10-0.17	7.4-8.4	Low	0.20		
WeB, WeC Wewela	0-8	2.0-6.0	0.14-0.17	6.1-7.3	Low	0.20	4	3
	8-16	0.6-2.0	0.16-0.18	6.1-7.3	Moderate	0.32		
	16-36	0.06-0.2	0.08-0.12	6.1-7.8	High	0.32		
	36-60	<0.06	---	6.6-8.4	High	---		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Ab: Albaton Variant	D	Occasional	Brief	Dec-Feb	1.0-3.0	Apparent	Nov-Apr	>60	---	High	High	Low.
AmB, An, AnC: Anselmo	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Ba: Barney	D	Frequent	Long	Mar-Jun	0-2.0	Apparent	Nov-Jun	>60	---	Moderate	High	Low.
Bo: Boel	A	Occasional	Brief	Mar-Jun	1.5-3.5	Apparent	Nov-May	>60	---	Moderate	High	Low.
Bt: Brocksburg	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
Cb: Cass	B	Rare	Brief	Mar-Jun	>6.0	---	---	>60	---	Moderate	Moderate	Low.
CcB: Cass	B	Frequent	Brief	Mar-Jun	>6.0	---	---	>60	---	Moderate	Moderate	Low.
DdB, DdC: Duda	A	None	---	---	>6.0	---	---	20-40	Rippable	Low	Moderate	Low.
DuB: Dunday	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
DxB*:												
Dunday	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
Duda	A	None	---	---	>6.0	---	---	20-40	Rippable	Low	Moderate	Low.
Eo: Els	A	Rare	---	---	1.5-3.5	Apparent	Nov-May	>60	---	Moderate	Moderate	Low.
Es: Elsmere	A	Rare	---	---	1.5-2.5	Apparent	Apr-Jun	>60	---	Moderate	Moderate	Low.
Ho, HoC: Holt	B	None	---	---	>6.0	---	---	20-40	Rippable	Moderate	Moderate	Low.
HtC*, HtD*:												
Holt	B	None	---	---	>6.0	---	---	20-40	Rippable	Moderate	Moderate	Low.
Tassel	D	None	---	---	>6.0	---	---	10-20	Rippable	Low	High	Low.
IfD: Inavale	A	Rare	Very brief	Jan-Jul	>6.0	---	---	>60	---	Low	High	Low.
IgB: Inavale	A	Frequent	Very brief	Jan-Jul	>6.0	---	---	>60	---	Low	High	Low.

IhB---------------- Inavale	A	Occasional	Very brief	Jan-Jul	>6.0	---	---	>60	---	Low------	High-----	Low.
IpB---------------- Ipage	A	None--------	---	---	3.0-6.0	Apparent	Dec-Jun	>60	---	Moderate	Low------	Moderate.
Ja, Jn, JnC-------- Jansen	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
JoB*:												
Jansen------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Meadin------------	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
LaD---------------- Labu	D	None--------	---	---	>6.0	---	---	20-40	Rippable	Low------	High-----	Moderate.
LcF*:												
Labu--------------	D	None--------	---	---	>6.0	---	---	20-40	Rippable	Low------	High-----	Moderate.
Sansarc-----------	D	None--------	---	---	>6.0	---	---	4-20	Rippable	Low------	High-----	Moderate.
Lo----------------- Loup	D	Occasional	Brief-----	Jan-Jul	0.0-1.5	Apparent	Nov-May	>60	---	Moderate	High-----	Low.
Lp**--------------- Loup	D	Frequent----	Brief-----	Jan-Jul	+.5-1.0	Apparent	Nov-May	>60	---	Moderate	High-----	Low.
MaB, MaC, MfC------ Manter	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
MkG*:												
Mariaville--------	D	None--------	---	---	>6.0	---	---	10-20	Rippable	Moderate	Moderate	Low.
Keota-------------	C	None--------	---	---	>6.0	---	---	20-40	Rippable	Low------	High-----	Low.
Mm**--------------- Marlake	D	Frequent----	Very long	Mar-Jun	+2-1.0	Apparent	Oct-Jun	>60	---	Moderate	High-----	Low.
MnF---------------- Meadin	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
Mu----------------- Munjor	B	Rare--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
OaB, Oe, OeC, OeD- O'Neill	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
OhB*:												
O'Neill-----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Meadin------------	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
OkD*:												
O'Neill-----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Valentine---------	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
On----------------- Onita	B	None--------	---	---	4.0-6.0	Perched	Mar-Jun	>60	---	Moderate	High-----	Low.

See footnotes at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
Or*:												
Ord	B	Occasional	Brief	Mar-May	1.5-3.5	Apparent	Nov-May	>60	---	High	High	Low.
Loup**	D	Occasional	Brief	Jan-Jul	+.5-1.5	Apparent	Nov-May	>60	---	Moderate	High	Low.
Pf, Ph, PhB Paka	B	None	---	---	>6.0	---	---	40-60	Rippable	Moderate	High	Low.
PmC*, PmF*:												
Paka	B	None	---	---	>6.0	---	---	40-60	Rippable	Moderate	High	Low.
Mariaville	D	None	---	---	>6.0	---	---	10-20	Rippable	Moderate	Moderate	Low.
RaB Ree	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Rb Ree	B	None	---	---	>6.0	---	---	40-60	Rippable	Moderate	High	Low.
ReC Reliance	C	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
RoD*, RoF*:												
Ronson	B	None	---	---	>6.0	---	---	20-40	Rippable	Moderate	Moderate	Low.
Anselmo	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
RtB*:												
Ronson	B	None	---	---	>6.0	---	---	20-40	Rippable	Moderate	Moderate	Low.
Tassel	D	None	---	---	>6.0	---	---	10-20	Rippable	Low	High	Low.
SaG Sansarc	D	None	---	---	>6.0	---	---	4-20	Rippable	Low	High	Moderate.
ScF Schamber	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
SmF*:												
Simeon	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
Manter	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Ronson	B	None	---	---	>6.0	---	---	20-40	Rippable	Moderate	Moderate	Low.
SvF2*, SwB*:												
Simeon	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
Valentine	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
TaF Tassel	D	None	---	---	>6.0	---	---	10-20	Rippable	Low	High	Low.
TdE*:												
Tassel	D	None	---	---	>6.0	---	---	10-20	Rippable	Low	High	Low.

TdE*:												
Duda	A	None	---	---	>6.0	---	---	20-40	Rippable	Low	Moderate	Low.
TrG*:												
Tassel	D	None	---	---	>6.0	---	---	10-20	Rippable	Low	High	Low.
Ronson	B	None	---	---	>6.0	---	---	20-40	Rippable	Moderate	Moderate	Low.
Duda	A	None	---	---	>6.0	---	---	20-40	Rippable	Low	Moderate	Low.
Tu Tuthill	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
VaF, VaG, VbD Valentine	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
VcF*:												
Valentine	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
Tassel	D	None	---	---	>6.0	---	---	10-20	Rippable	Low	High	Low.
VdC*, VdF*:												
Valentine	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
Valentine, clayey substratum	A	None	---	---	3.0-5.0	Perched	Mar-Jun	>60	---	Low	High	Low.
Wewela	B	None	---	---	>6.0	---	---	20-40	Rippable	Moderate	High	Moderate.
Ve, VeB, VeC Verdel	D	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Vo, Vt, VtB, VtC Vetal	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
WeB, WeC Wewela	B	None	---	---	>6.0	---	---	20-40	Rippable	Moderate	High	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

** In the "High water table--Depth" column, a plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

TABLE 18.--ENGINEERING INDEX TEST DATA

[Dashes indicate that data were not available. NP means nonplastic]

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution										Liquid limit	Plasticity index	Particle density
			Percentage passing sieve--							Percentage smaller than--					
	AASHTO	Unified	2 inch	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm			
													Pct		G/cc
Brocksburg loam: (S75NE-103-001)															
A1------- 0 to 15	A-4(03)	CL-ML	100	100	100	100	99	80	51	24	13	11	25	7	2.61
B21t-----15 to 21	A-7-6(12)	CL	100	100	100	100	98	89	76	43	29	26	41	20	2.63
IIc2-----30 to 60	A-1-B(03)	SP-SM	100	100	100	98	87	44	7	4	3	3	--	NP	2.63
Holt fine sandy loam: (S75NE-103-004)															
A1------- 0 to 6	A-4(03)	SM	100	100	100	100	100	97	48	19	13	9	21	1	2.60
B2-------13 to 23	A-4(00)	SM-SC	100	100	100	100	100	97	37	19	15	12	24	5	2.60
IIc------23 to 30	A-2-4(00)	SM	100	99	98	97	97	94	31	15	8	7	--	NP	2.57
Labu silty clay loam: (S76NE-103-004)															
A-------- 0 to 5	A-7-5(20)	MH	100	100	100	100	100	99	97	87	62	49	60	29	2.64
B-------- 5 to 20	A-7-6(19)	CH	100	100	100	100	100	99	95	83	60	48	57	29	2.73
C--------20 to 36	A-7-6(21)	CH	100	100	100	100	100	99	97	86	67	52	59	32	2.72
Loup fine sandy loam: (S75NE-103-002)															
A1------- 0 to 7	A-7-6(10)	CL	100	100	100	100	100	98	59	36	22	20	46	22	2.52
C1-------13 to 20	A-3(02)	SP-SM	100	100	100	100	100	98	7	3	1	1	--	NP	2.65
Ord fine sandy loam: (S75NE-103-003)															
A11------ 0 to 7	A-6(03)	SC	100	100	100	100	100	97	46	30	21	15	33	12	2.56
A13------13 to 19	A-2-4(00)	SM-SC	100	100	100	100	99	93	31	20	16	14	23	6	2.63
C1-------23 to 30	A-3(02)	SP-SM	100	100	100	100	100	95	7	5	4	4	--	NP	2.64
Tuthill fine sandy loam: (S76NE-103-001)															
Ap------- 0 to 7	A-4(01)	SM	100	100	100	100	100	97	42	17	12	10	21	NP	2.60
A12------ 7 to 11	A-4(01)	SM	100	100	100	100	100	97	38	21	14	14	20	NP	2.64
B1-------11 to 18	A-4(00)	SM-SC	100	100	100	100	100	97	37	21	16	16	22	4	2.66
B21t-----18 to 24	A-6(12)	CL	100	100	100	100	100	99	80	46	33	29	39	20	2.67
C1-------27 to 48	A-4(01)	SM	100	100	100	100	100	97	42	11	9	6	--	NP	2.61
Valentine fine sand: (S76NE-103-003)															
A-------- 0 to 7	A-3(02)	SP-SM	100	100	100	100	100	95	7	5	4	4	--	NP	2.65
C--------16 to 60	A-3(02)	SP-SM	100	100	100	100	100	96	5	4	4	3	--	NP	2.64

See footnotes at end of table.

TABLE 18.--ENGINEERING INDEX TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution										Liquid limit	Plasticity index	Particle density
			Percentage passing sieve--							Percentage smaller than--					
	AASHTO	Unified	2 inch	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm			
													Pct		G/cc
Vetal loam: (S75NE-103-005)															
Ap------- 0 to 6	A-4(08)	ML	100	100	100	100	100	99	77	32	19	16	29	6	2.56
B21------18 to 25	A-4(07)	CL	100	100	100	100	100	99	70	30	20	17	29	10	2.64

TABLE 19.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Albaton Variant	Fine, montmorillonitic (calcareous), mesic Vertic Fluvaquents
Anselmo	Coarse-loamy, mixed, mesic Typic Haplustolls
Barney	Sandy, mixed, mesic Mollic Fluvaquents
Boel	Sandy, mixed, mesic Fluvaquentic Haplustolls
Brocksburg	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Pachic Argiustolls
Cass	Coarse-loamy, mixed, mesic Fluventic Haplustolls
Duda	Mixed, mesic Typic Ustipsamments
Dunday	Sandy, mixed, mesic Entic Haplustolls
Els	Mixed, mesic Aquic Ustipsamments
Elsmere	Sandy, mixed, mesic Aquic Haplustolls
Holt	Coarse-loamy, mixed, mesic Typic Argiustolls
Inavale	Sandy, mixed, mesic Typic Ustifluvents
Ipage	Mixed, mesic Aquic Ustipsamments
Jansen	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Argiustolls
*Keota	Coarse-silty, mixed (calcareous), mesic Ustic Torriorthents
Labu	Fine, montmorillonitic, mesic Vertic Ustochrepts
Loup	Sandy, mixed, mesic Typic Haplaquolls
*Manter	Coarse-loamy, mixed, mesic Aridic Argiustolls
Mariaville	Loamy, mixed (calcareous), mesic, shallow Typic Ustorthents
Marlake	Sandy, mixed, mesic Mollic Fluvaquents
Meadin	Sandy-skeletal, mixed, mesic Entic Haplustolls
Munjor	Coarse-loamy, mixed (calcareous), mesic Typic Ustifluvents
O'Neill	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haplustolls
Onita	Fine, montmorillonitic, mesic Pachic Argiustolls
Ord	Coarse-loamy, mixed, mesic Fluvaquentic Haplustolls
Paka	Fine-silty, mixed, mesic Typic Argiustolls
Ree	Fine-loamy, mixed, mesic Typic Argiustolls
Reliance	Fine, montmorillonitic, mesic Typic Argiustolls
Ronson	Coarse-loamy, mixed, mesic Entic Haplustolls
Sansarc	Clayey, montmorillonitic (calcareous), mesic, shallow Typic Ustorthents
*Schamber	Sandy-skeletal, mixed, mesic Ustic Torriorthents
Simeon	Mixed, mesic Typic Ustipsamments
*Tassel	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
*Tuthill	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Argiustolls
Valentine	Mixed, mesic Typic Ustipsamments
Verdel	Fine, montmorillonitic, mesic Vertic Haplustolls
Vetal	Coarse-loamy, mixed, mesic Pachic Haplustolls
Wewela	Fine-loamy, mixed, mesic Typic Argiustolls

*The soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

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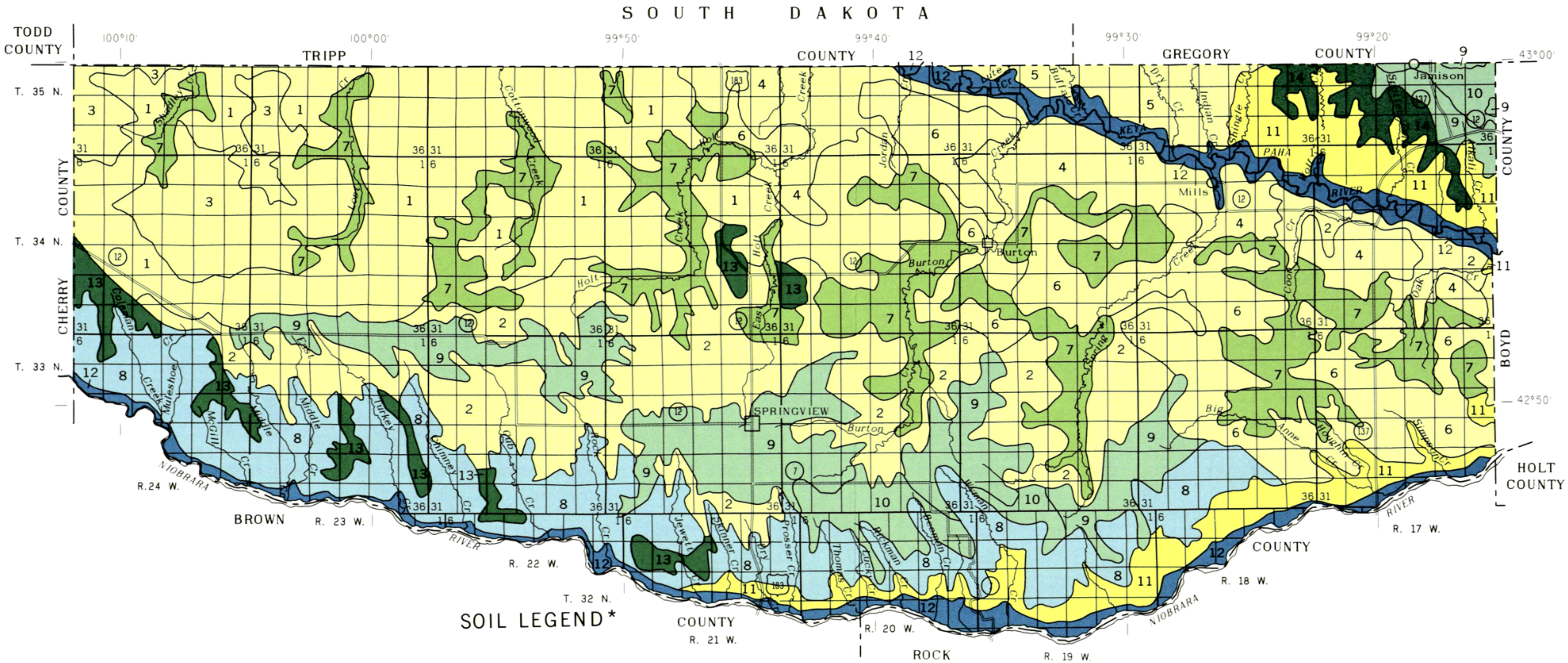


SOIL LEGEND*

DOMINANTLY SANDY AND LOAMY SOILS ON EOLIAN AND RESIDUAL UPLANDS

1 — Valentine–Tassel association: Deep and shallow, gently sloping to steep, excessively drained and well drained sandy soils that formed in windblown material or in residuum of sandstone

2 — Manter–Valentine association: Deep, nearly level to moderately steep, excessively drained and well drained sandy soils that formed in windblown material

3 — Tassel–Duda–Ronson association: Shallow and moderately deep, nearly level to moderately steep, well drained loamy and sandy soils that formed in windblown material or in residuum of sandstone

4 — Wewela–Valentine–Anselmo association: Moderately deep and deep, nearly level to steep, well drained and excessively drained loamy and sandy soils that formed in windblown material or in residuum of shale

5 — Anselmo–Labu association: Deep and moderately deep, gently sloping to steep, well drained loamy and clayey soils that formed in windblown material or in residuum of shale

6 — Valentine association: Deep, gently rolling to hilly, excessively drained sandy soils that formed in windblown material

DOMINANTLY SANDY AND LOAMY SOILS IN BROAD UPLAND VALLEYS

7 — Ipage–Loup–Ord association: Deep, nearly level and very gently sloping, moderately well drained to very poorly drained sandy and loamy soils that formed in windblown and alluvial material

DOMINANTLY SANDY, LOAMY, AND SILTY SOILS ON BREAKS TO THE NIOBRARA RIVER VALLEY

8 — Tassel–Mariaville–Ronson association: Shallow and moderately deep, steep and very steep, well drained sandy, loamy, and silty soils that formed in residuum of sandstone and siltstone

DOMINANTLY LOAMY SOILS UNDERLAIN BY SAND AND GRAVEL; ON UPLANDS

9 — Meadin–Jansen–O'Neill association: Nearly level to steep, well drained and excessively drained loamy soils that are shallow or moderately deep over sand and gravel; these soils formed in loamy and loesslike material

10 — Jansen–Brocksburg–O'Neill association: Nearly level to gently sloping, well drained loamy soils that are moderately deep over sand and gravel; these soils formed in loamy and loesslike material

DOMINANTLY CLAYEY SOILS ON RESIDUAL UPLANDS

11 — Labu–Sansarc association: Moderately deep and shallow, strongly sloping to very steep, well drained clayey soils that formed in residuum of shale

DOMINANTLY SANDY, LOAMY, AND SILTY SOILS ON FLOOD PLAINS AND TERRACES

12 — Inavale–Cass–Verdel association: Deep, nearly level to strongly sloping, well drained and somewhat excessively drained sandy, loamy, and silty soils that formed in deposits of alluvial and colluvial material

DOMINANTLY LOAMY AND SILTY SOILS ON EOLIAN AND RESIDUAL UPLANDS

13 — Vetal–Holt association: Deep and moderately deep, nearly level to strongly sloping, well drained loamy soils that formed in loess and loamy material or in residuum of sandstone

14 — Reliance–Ree–Jansen association: Nearly level to gently sloping, well drained silty and loamy soils that are deep or moderately deep over sand and gravel; these soils formed in silty loesslike material and loamy material

* The texture given in the legend headings is that of the surface layer of the major soils.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
UNIVERSITY OF NEBRASKA CONSERVATION AND SURVEY DIVISION

GENERAL SOIL MAP

KEYA PAHA COUNTY, NEBRASKA

Scale 1: 253,440

1 0 1 2 3 4 Miles

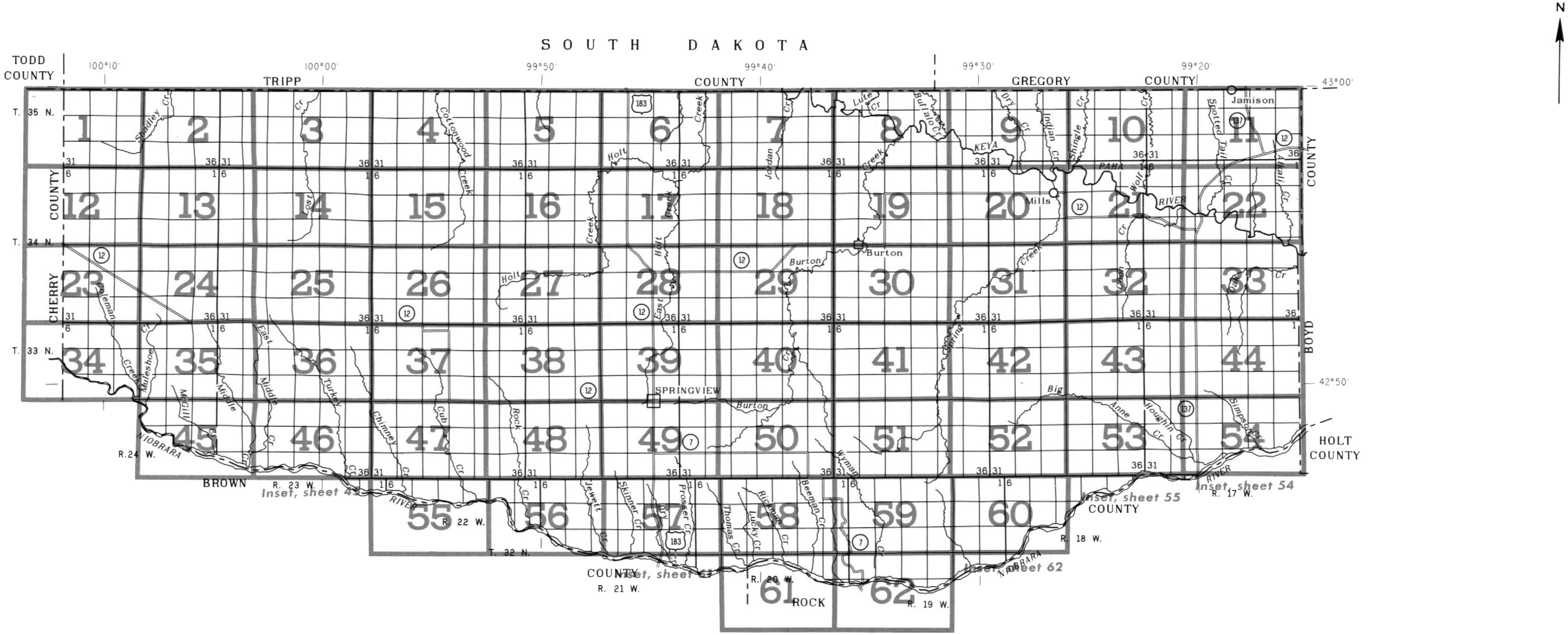
1 0 1 2 3 4 5 6 Kilometers

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

Compiled 1979



INDEX TO MAP SHEETS

KEYA PAHA COUNTY, NEBRASKA

Scale 1: 253,440

1 0 1 2 3 4 Miles

1 0 1 2 3 4 5 6 Kilometers

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

SOIL LEGEND

Map symbols consist of a combination of letters or of letters and numbers. The first capital letter is the initial one of the soil name. The lowercase letter that follows separates map units having names that begin with the same letter, except that it does not separate sloping or eroded phases. The second capital letter indicates the class of slope. Symbols without a slope letter are for nearly level soils. A final number of 2 indicates that the soil is eroded.

SYMBOL	NAME
Ab	Albaton Variant clay, 0 to 2 percent slopes
AmB	Anselmo loamy fine sand, 0 to 3 percent slopes
An	Anselmo fine sandy loam, 0 to 2 percent slopes
AnC	Anselmo fine sandy loam, 2 to 6 percent slopes
Ba	Barney fine sandy loam, 0 to 2 percent slopes
Bo	Boel fine sandy loam, 0 to 2 percent slopes
Bt	Brocksburg loam, 0 to 1 percent slopes
Cb	Cass loam, 0 to 2 percent slopes
CcB	Cass loam, channeled, 0 to 3 percent slopes
DdB	Duda loamy fine sand, 0 to 3 percent slopes
DdC	Duda loamy fine sand, 3 to 6 percent slopes
DuB	Dunday loamy fine sand, 0 to 3 percent slopes
DxB	Dunday–Duda loamy fine sands, 0 to 3 percent slopes
Eo	Els fine sand, 0 to 2 percent slopes
Es	Elsmere loamy fine sand, 0 to 2 percent slopes
Ho	Holt fine sandy loam, 0 to 2 percent slopes
HoC	Holt fine sandy loam, 2 to 6 percent slopes
HtC	Holt–Tassel fine sandy loams, 3 to 6 percent slopes
HtD	Holt–Tassel fine sandy loams, 6 to 11 percent slopes
IfD	Inavale fine sand, 3 to 11 percent slopes
IgB	Inavale fine sand, channeled, 0 to 3 percent slopes
IhB	Inavale loamy fine sand, 0 to 3 percent slopes
IpB	Ipage loamy fine sand, 0 to 3 percent slopes
Ja	Jansen fine sandy loam, 0 to 2 percent slopes
Jn	Jansen loam, 0 to 2 percent slopes
JnC	Jansen loam, 2 to 6 percent slopes
JoB	Jansen–Meadin loams, 0 to 3 percent slopes
LaD	Labu silty clay, 6 to 11 percent slopes
LcF	Labu–Sansarc silty clays, 11 to 30 percent slopes
Lo	Loup fine sandy loam, 0 to 2 percent slopes
Lp	Loup fine sandy loam, wet, 0 to 2 percent slopes
MaB	Manter loamy fine sand, 0 to 3 percent slopes
MaC	Manter loamy fine sand, 3 to 6 percent slopes
MfC	Manter fine sandy loam, 2 to 6 percent slopes
MkG	Mariaville–Keota silt loams, 15 to 60 percent slopes
Mm	Marlake loamy fine sand, 0 to 1 percent slopes
MnF	Meadin gravelly sandy loam, 3 to 30 percent slopes
Mu	Munjor fine sandy loam, 0 to 2 percent slopes
OaB	O'Neill loamy fine sand, 0 to 3 percent slopes
Oe	O'Neill fine sandy loam, 0 to 2 percent slopes
OeC	O'Neill fine sandy loam, 2 to 6 percent slopes
OeD	O'Neill fine sandy loam, 6 to 9 percent slopes
OhB	O'Neill–Meadin fine sandy loams, 0 to 3 percent slopes
OkD	O'Neill–Valentine complex, 1 to 9 percent slopes
On	Onita silt loam, 0 to 1 percent slopes
Or	Ord–Loup fine sandy loams, 0 to 2 percent slopes
Pf	Paka fine sandy loam, 0 to 2 percent slopes
Ph	Paka loam, 0 to 1 percent slopes
PhB	Paka loam, 1 to 3 percent slopes
PmC	Paka–Mariaville loams, 3 to 6 percent slopes
PmF	Paka–Mariaville loams, 11 to 30 percent slopes
RaB	Ree loam, 1 to 3 percent slopes
Rb	Ree loam, clayey substratum, 0 to 2 percent slopes
ReC	Reliance silt loam, 2 to 6 percent slopes
RoD	Ronson–Anselmo fine sandy loams, 6 to 9 percent slopes
RoF	Ronson–Anselmo fine sandy loams, 9 to 30 percent slopes
RtB	Ronson–Tassel fine sandy loams, 0 to 3 percent slopes
SaG	Sansarc silty clay, 20 to 40 percent slopes
ScF	Schamber gravelly sandy loam, 11 to 30 percent slopes
SmF	Simeon–Manter–Ronson complex, 6 to 17 percent slopes
SvF2	Simeon–Valentine fine sands, 6 to 17 percent slopes, eroded
SwB	Simeon–Valentine loamy sands, 0 to 3 percent slopes
TaF	Tassel loamy fine sand, 3 to 30 percent slopes
TdE	Tassel–Duda complex, 3 to 15 percent slopes
TrG	Tassel–Ronson–Duda complex, 15 to 70 percent slopes
Tu	Tuthill fine sandy loam, 0 to 2 percent slopes
VaF	Valentine fine sand, rolling
VaG	Valentine fine sand, hilly
VbD	Valentine loamy fine sand, gently rolling
VcF	Valentine–Tassel complex, rolling
VdC	Valentine–Wewela loamy fine sands, 3 to 6 percent slopes
VdF	Valentine–Wewela loamy fine sands, 6 to 30 percent slopes
Ve	Verdel silty clay loam, 0 to 1 percent slopes
VeB	Verdel silty clay loam, 1 to 3 percent slopes
VeC	Verdel silty clay loam, 3 to 6 percent slopes
Vo	Vetal fine sandy loam, 0 to 2 percent slopes
Vt	Vetal loam, 0 to 1 percent slopes
VtB	Vetal loam, 1 to 3 percent slopes
VtC	Vetal loam, 3 to 6 percent slopes
WeB	Wewela fine sandy loam, 0 to 3 percent slopes
WeC	Wewela fine sandy loam, 3 to 6 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool (Davis Airstrip; FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (79)
- Federal (410)
- State (52)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water; w)

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water; w)
- Intermittent (int; i)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (CeA; FoB2)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) (S)

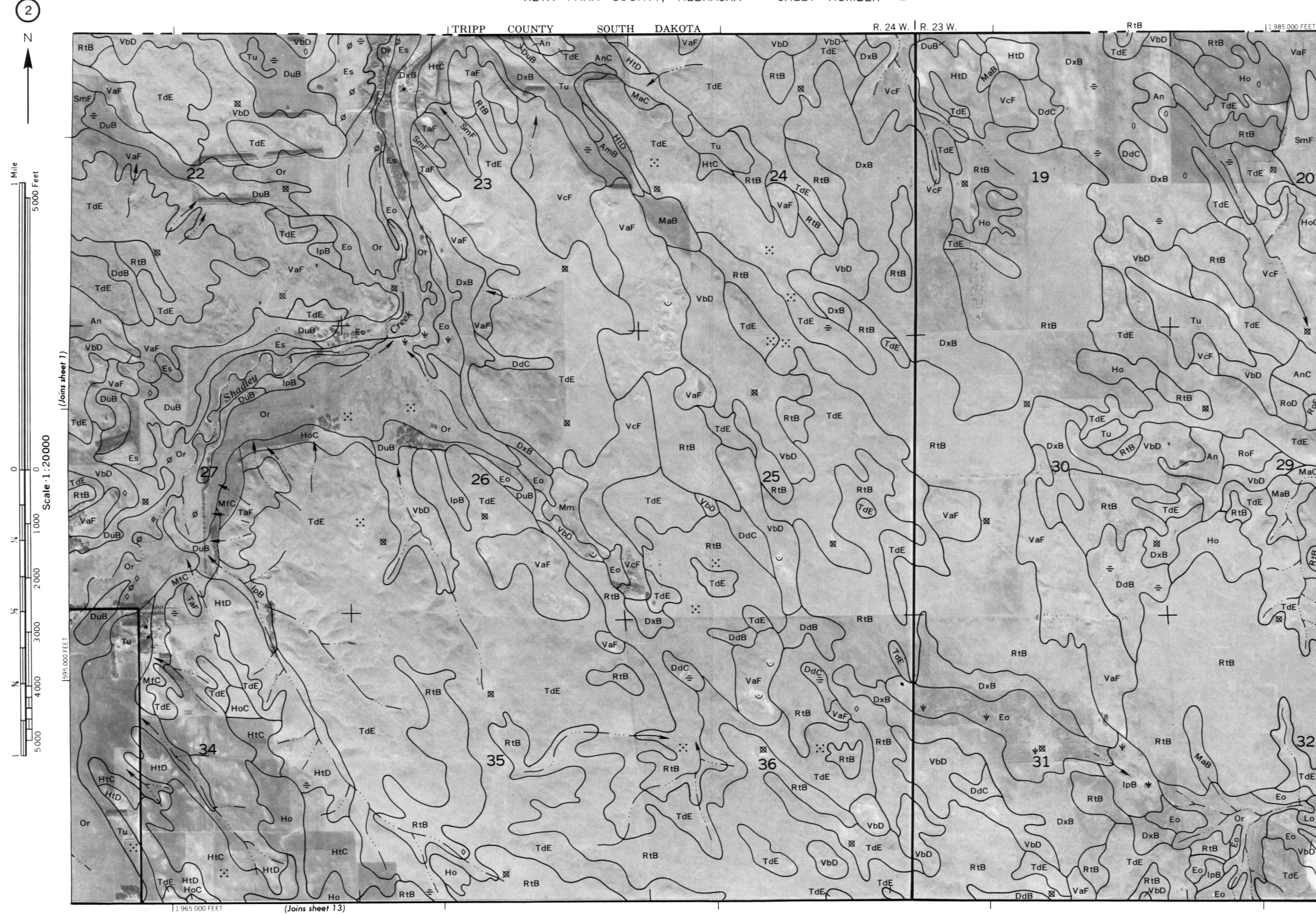
MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Water facility
- Quarzite boulders

KEYA PAHA COUNTY, NEBRASKA NO. 1

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2



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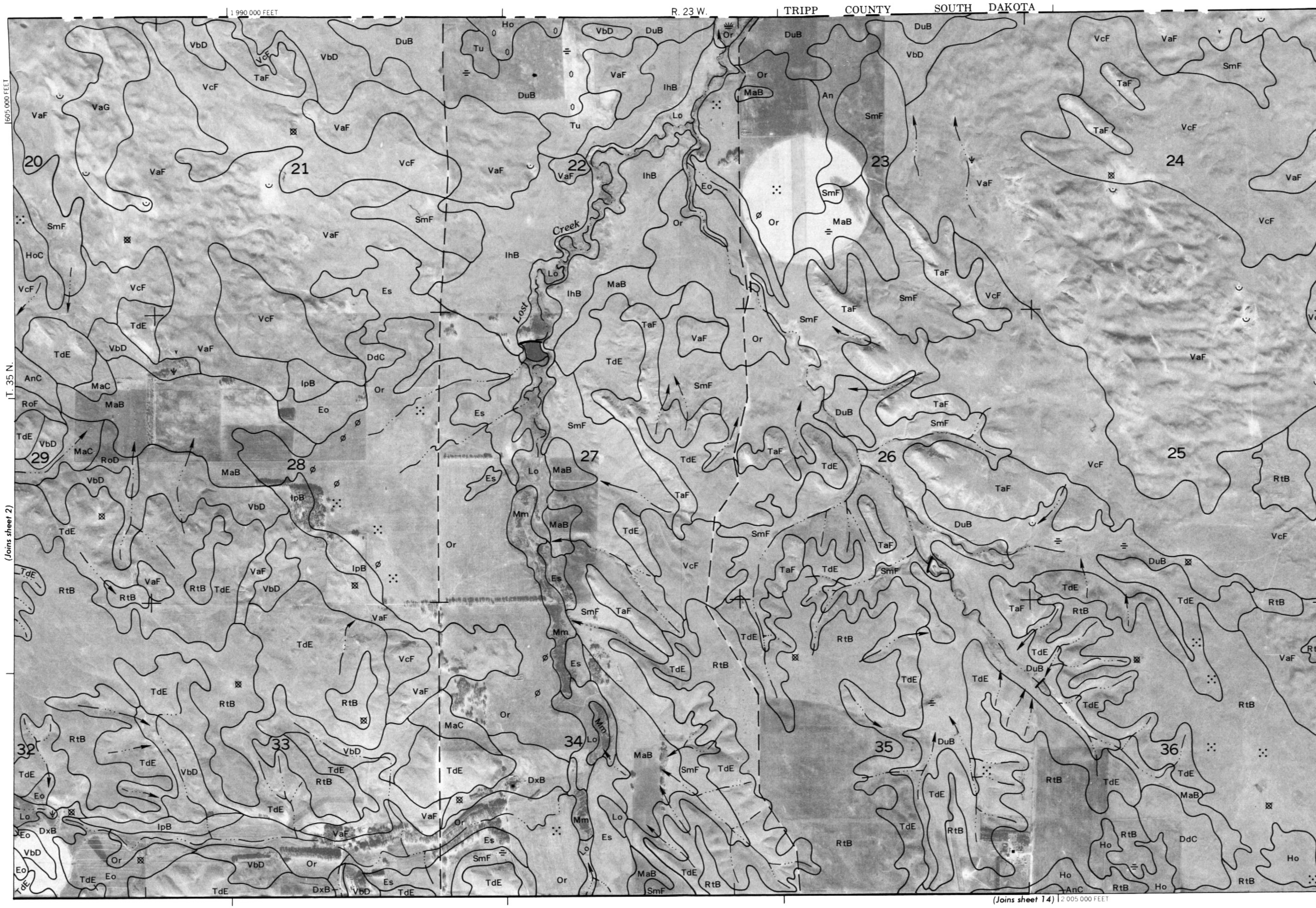
KEYA PAHA COUNTY, NEBRASKA NO. 2

3



N

Scale 1:20000

1 Mile

5000 Feet

0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

KEYA PAHA COUNTY, NEBRASKA NO. 3

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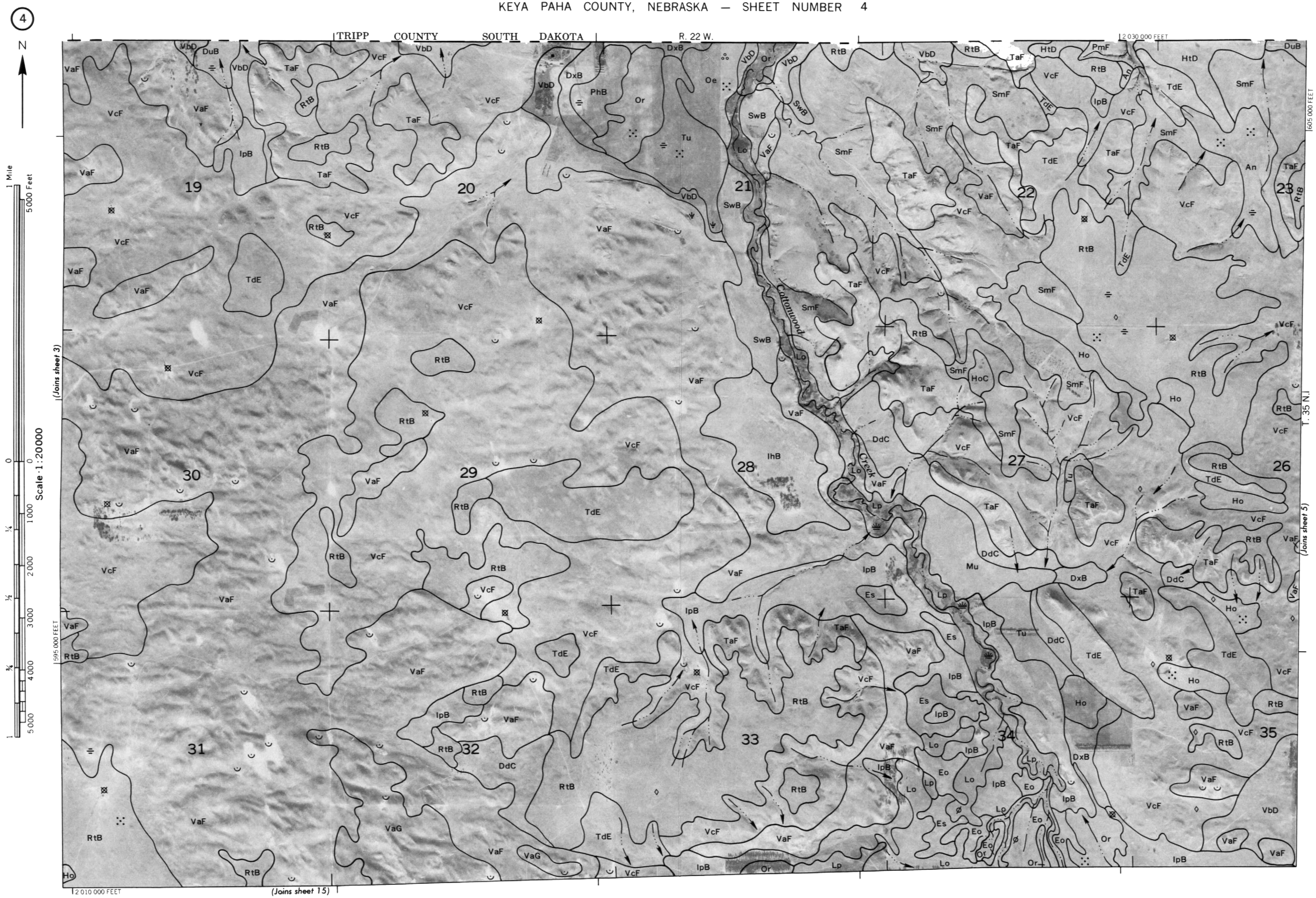

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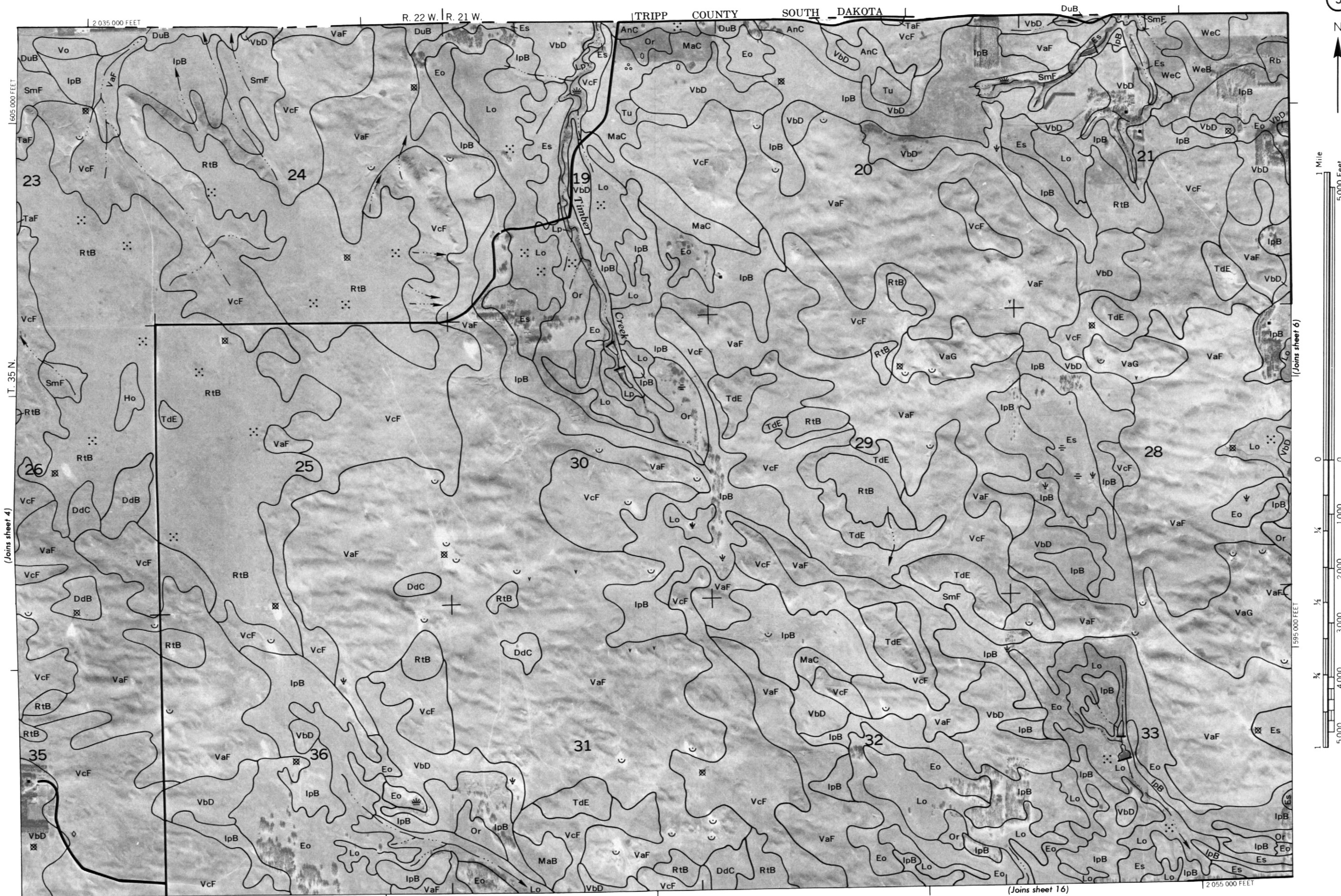

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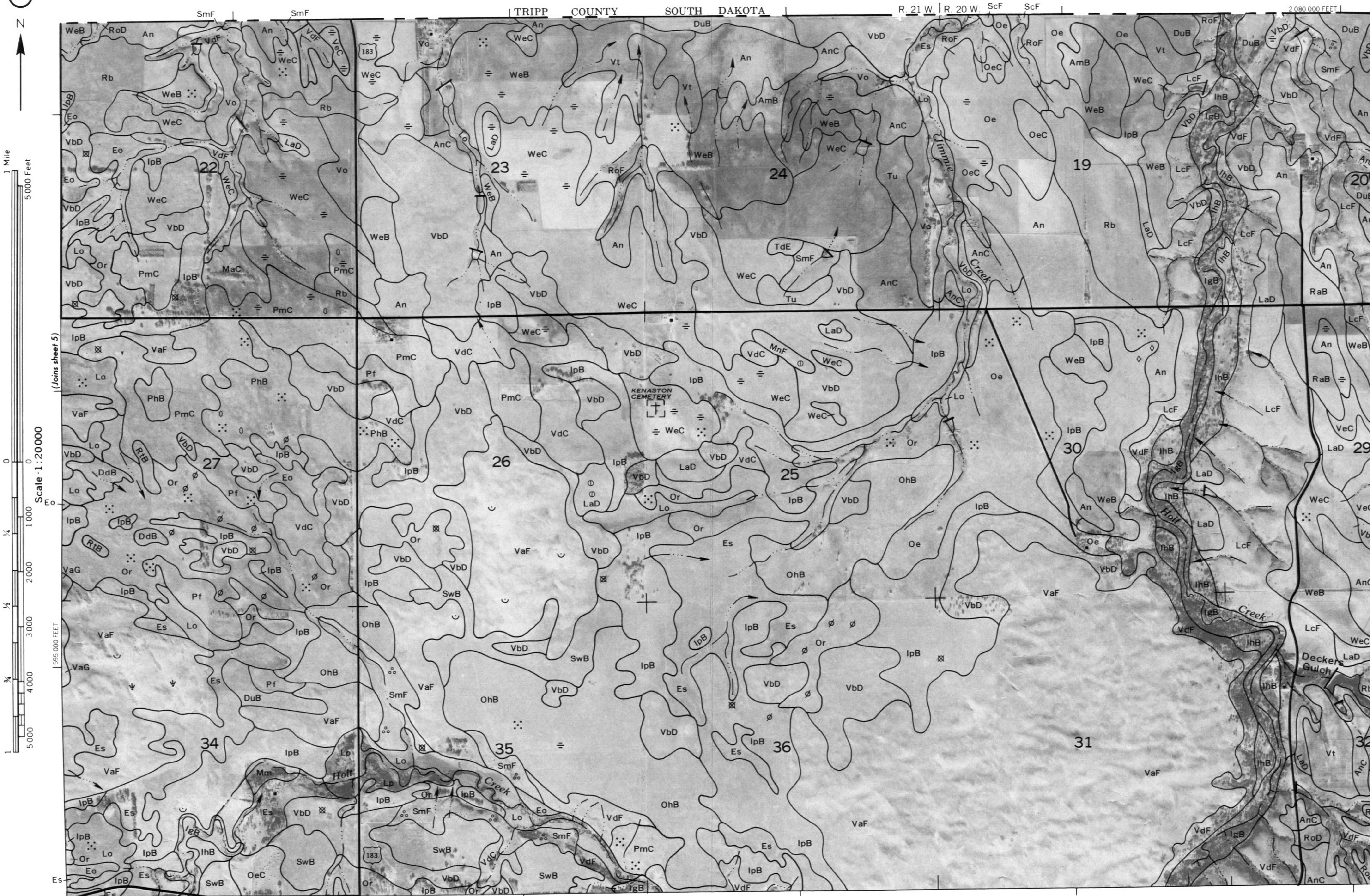

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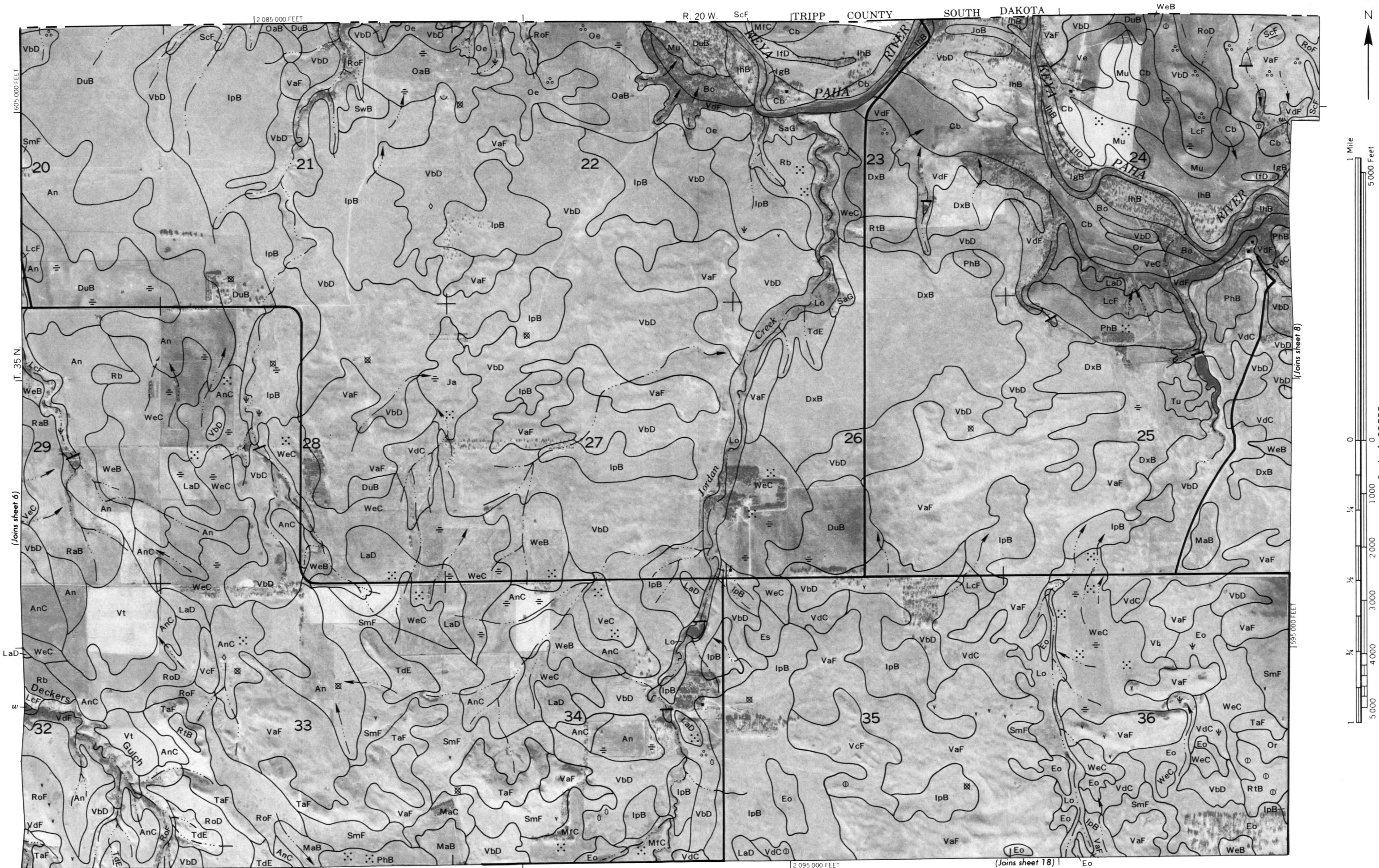

KEYA PAHA COUNTY, NEBRASKA NO. 7

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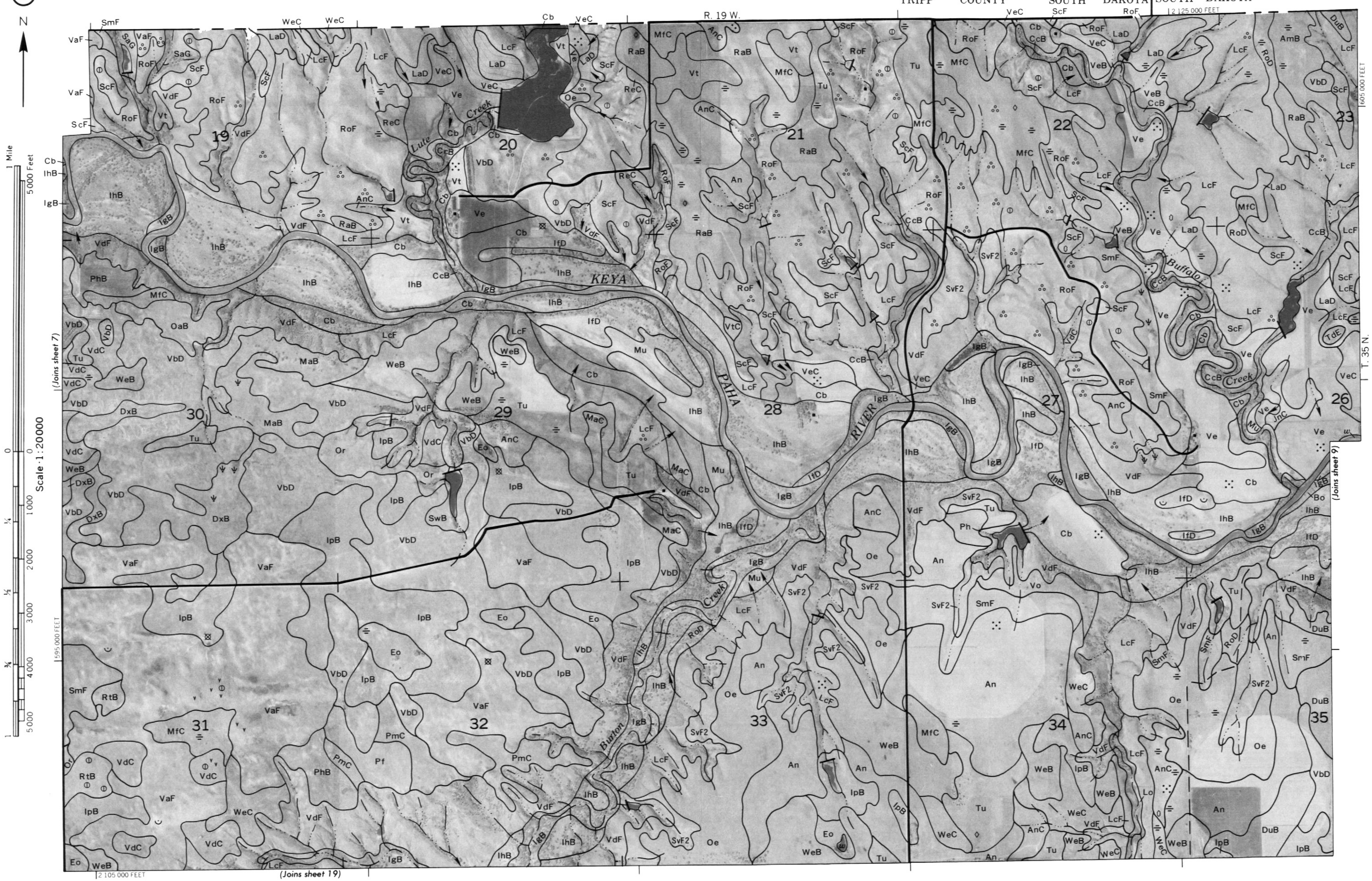
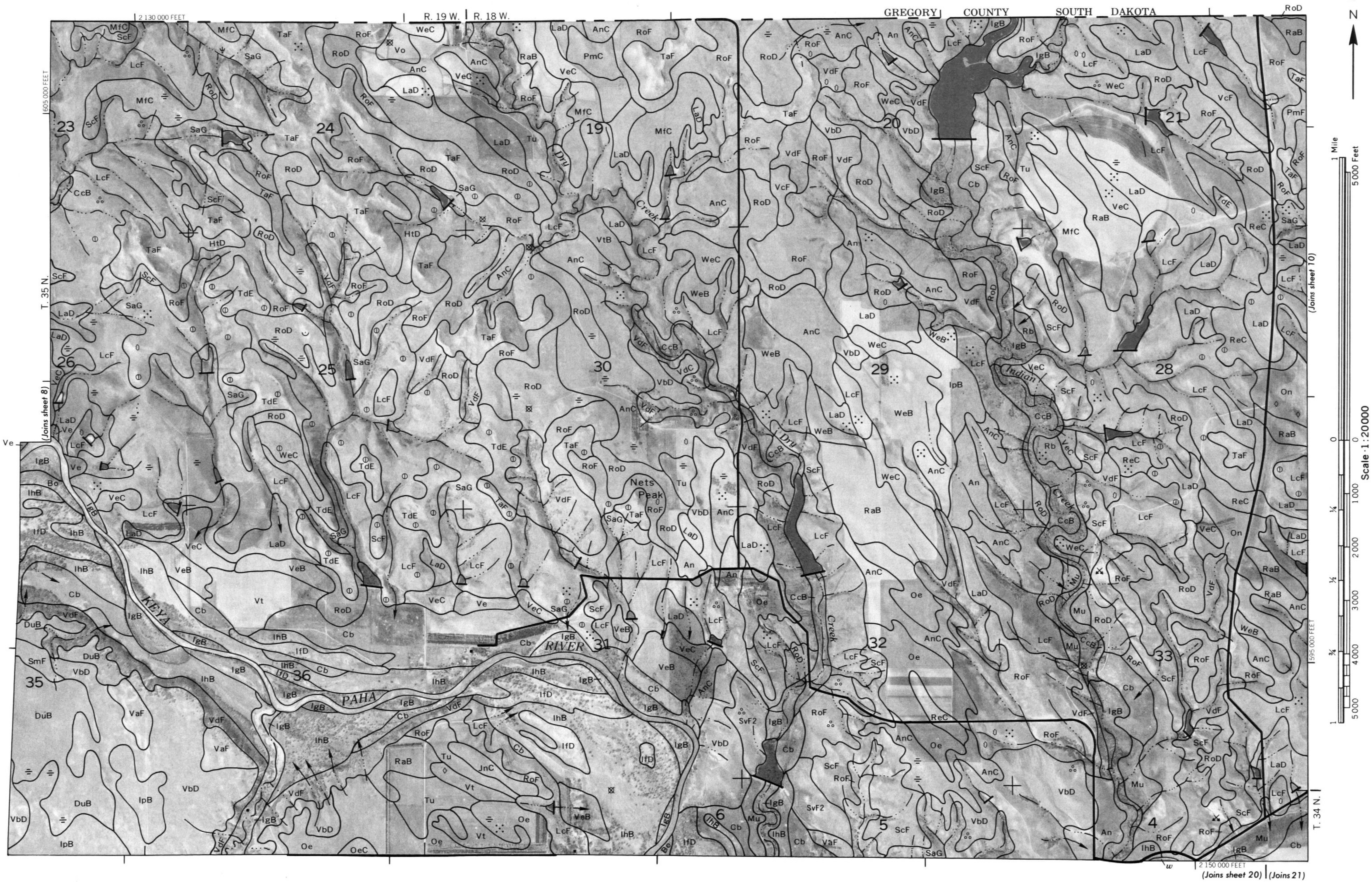
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

KEYA PAHA COUNTY, NEBRASKA — SHEET NUMBER 8



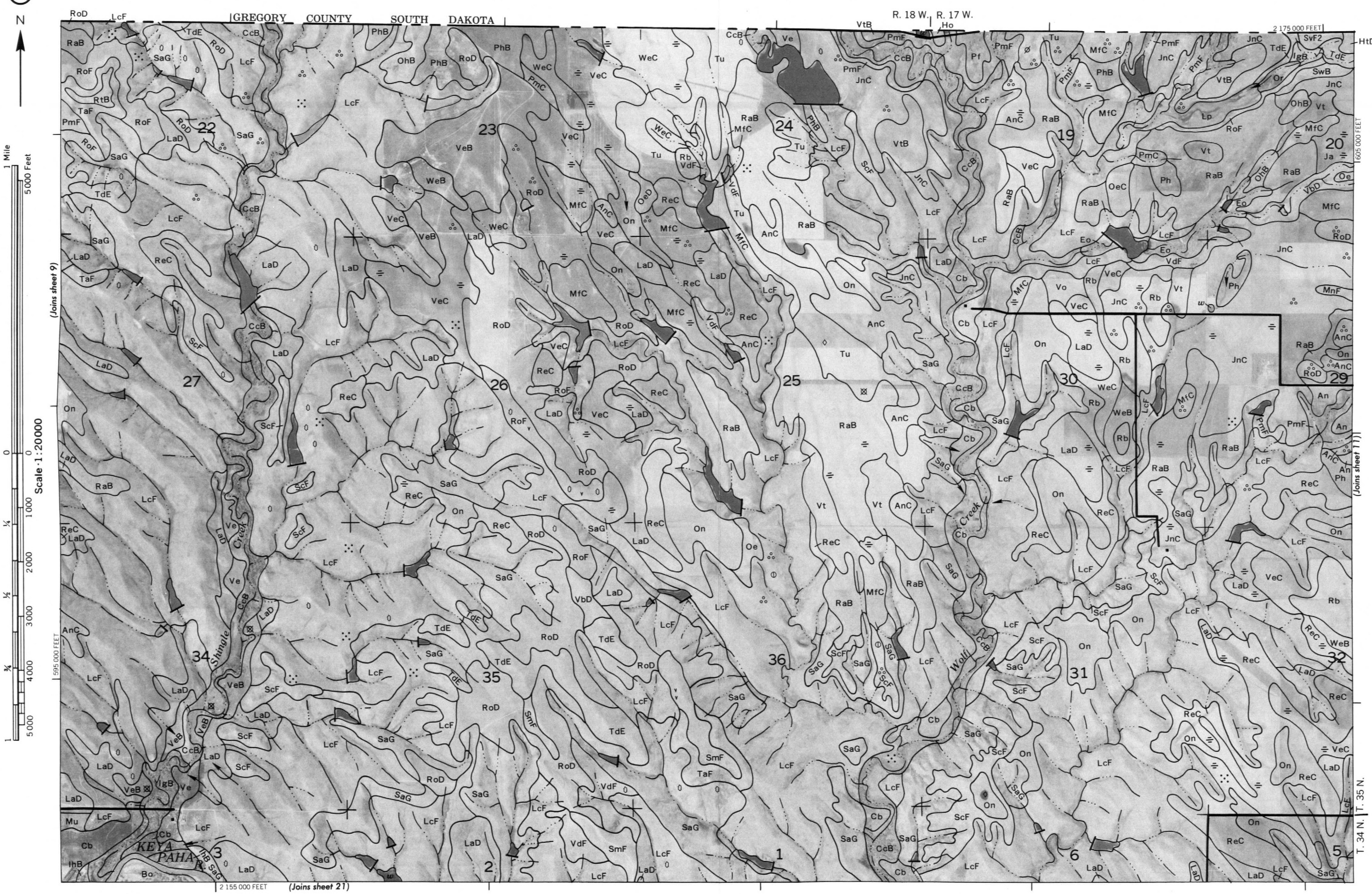
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



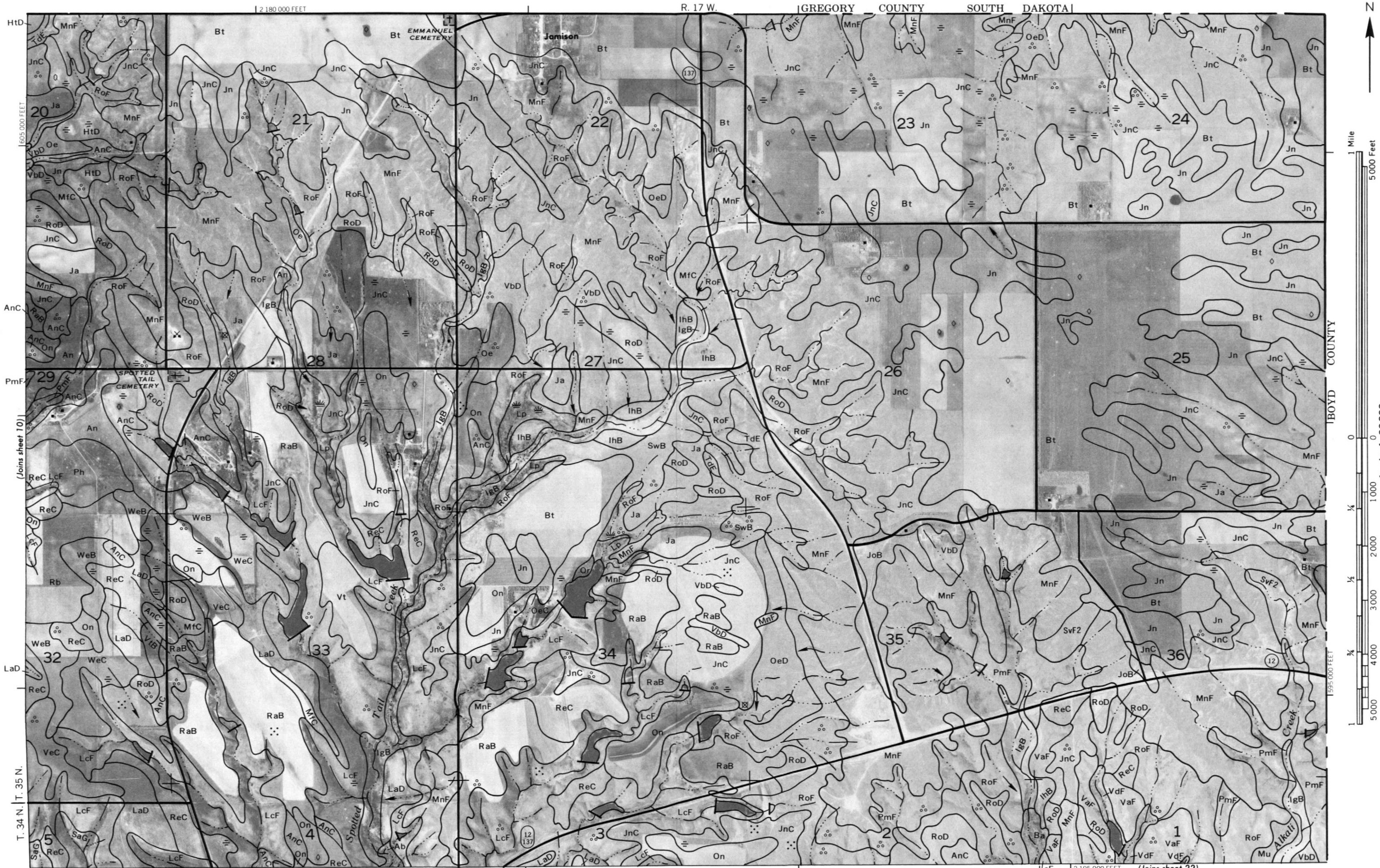
KEYA PAHA COUNTY, NEBRASKA NO. 9

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(10)



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



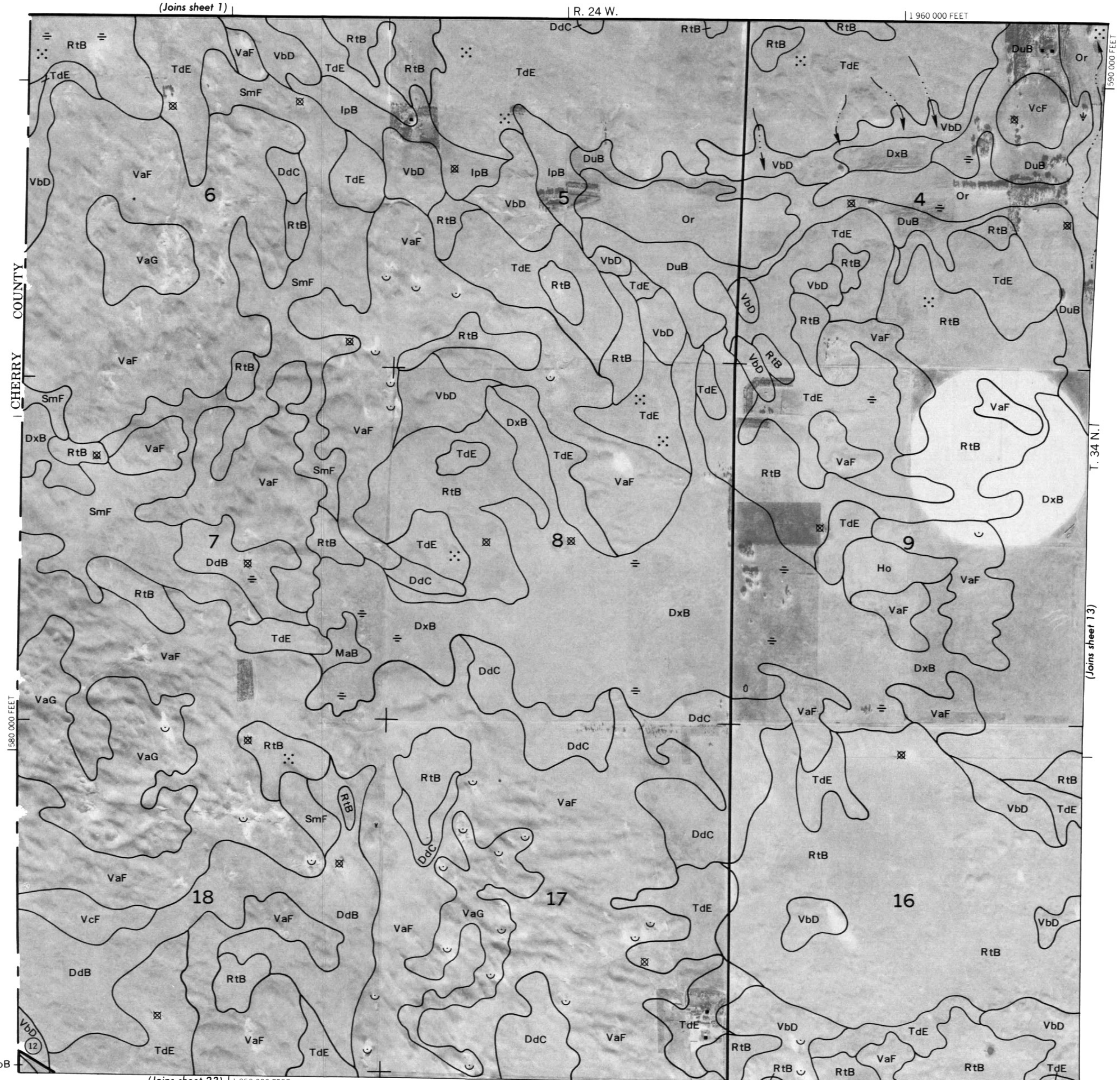
KEYA PAHA COUNTY, NEBRASKA NO. 11

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

KEYA PAHA COUNTY, NEBRASKA — SHEET NUMBER 12

N

1 Mile
5 000 Feet
0
0
Scale 1:20000
1 000
¼
2 000
½
3 000
¾
4 000
1
5 000

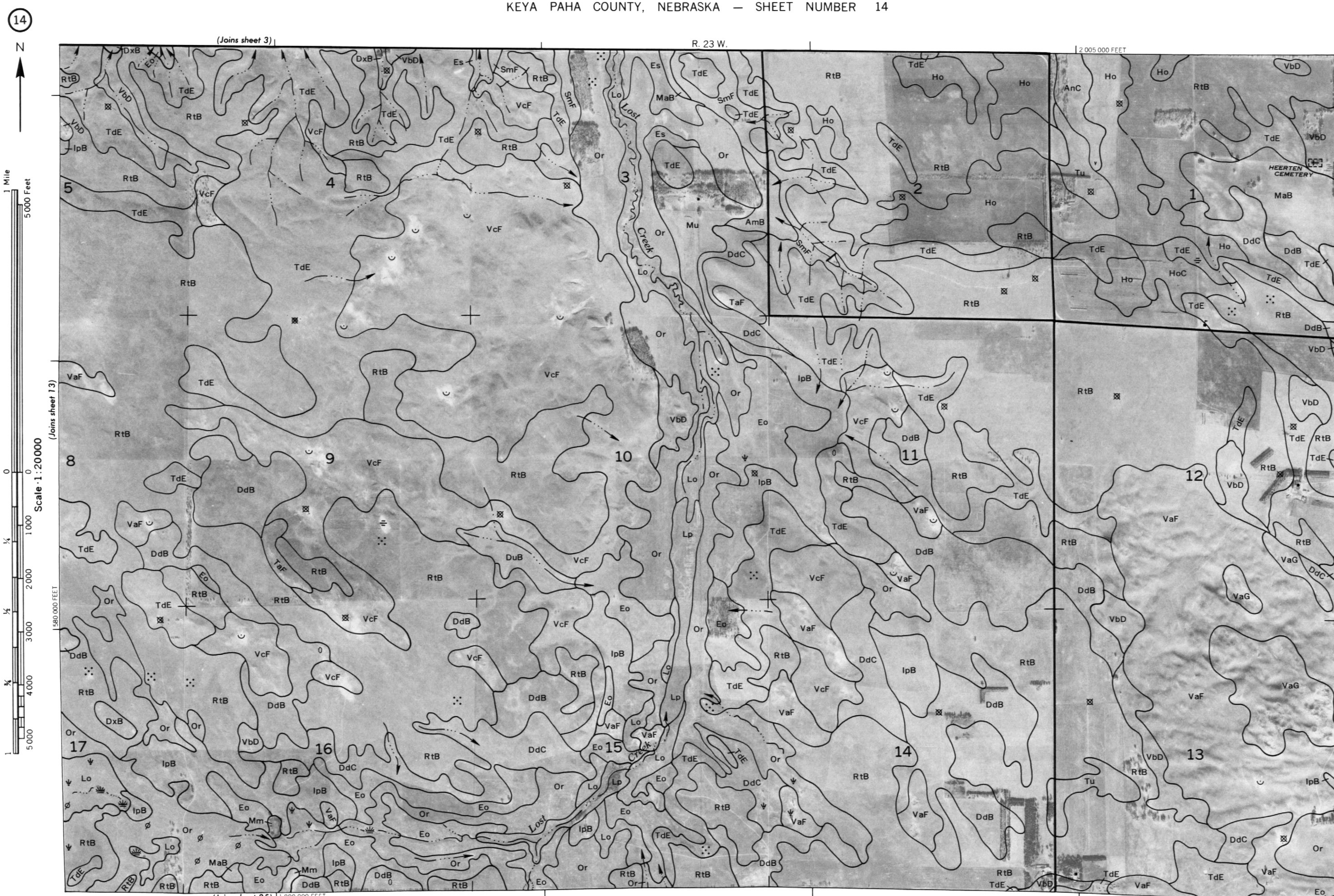


This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

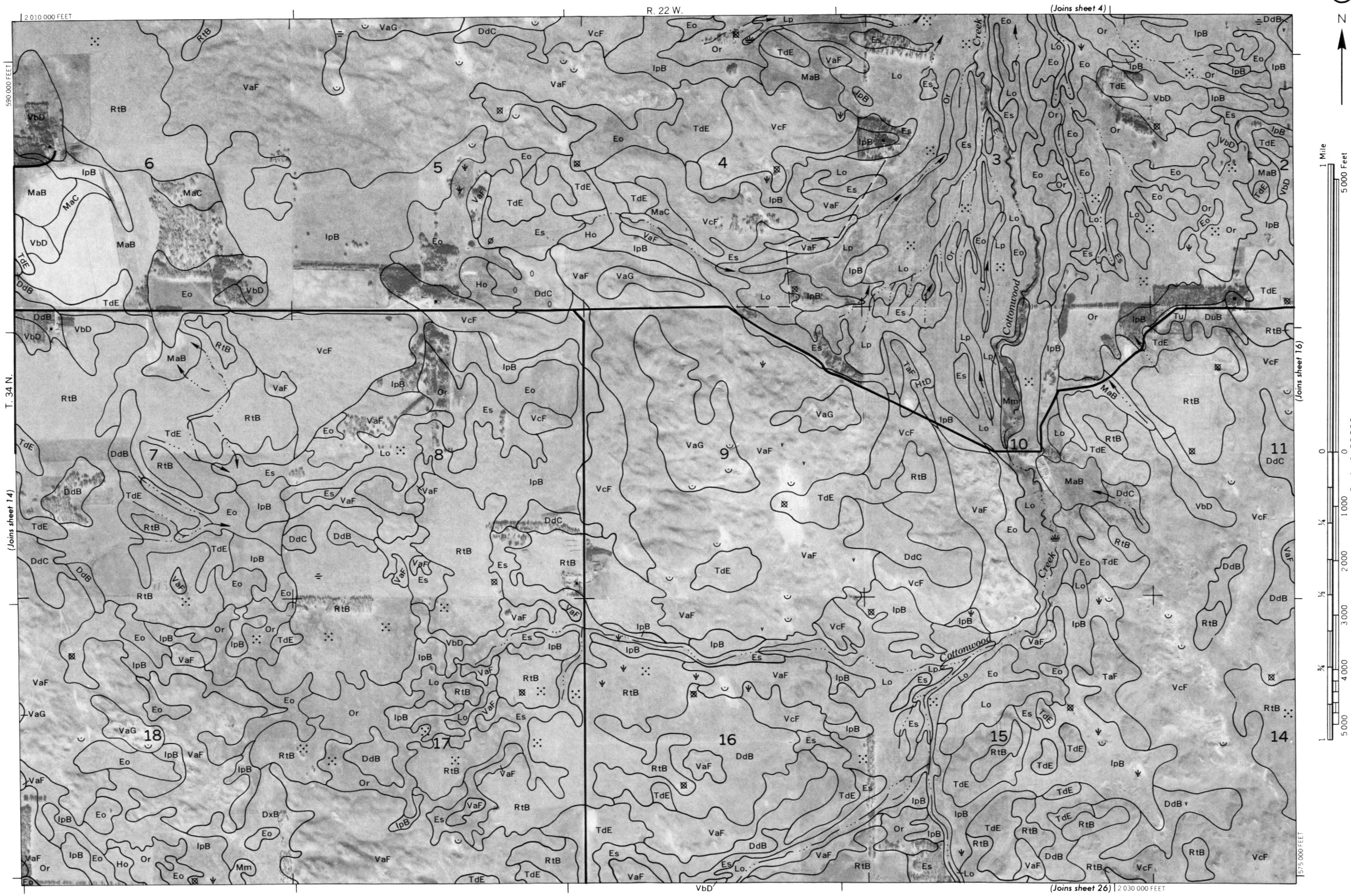
13

KEYA PAHA COUNTY, NEBRASKA NO. 13

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

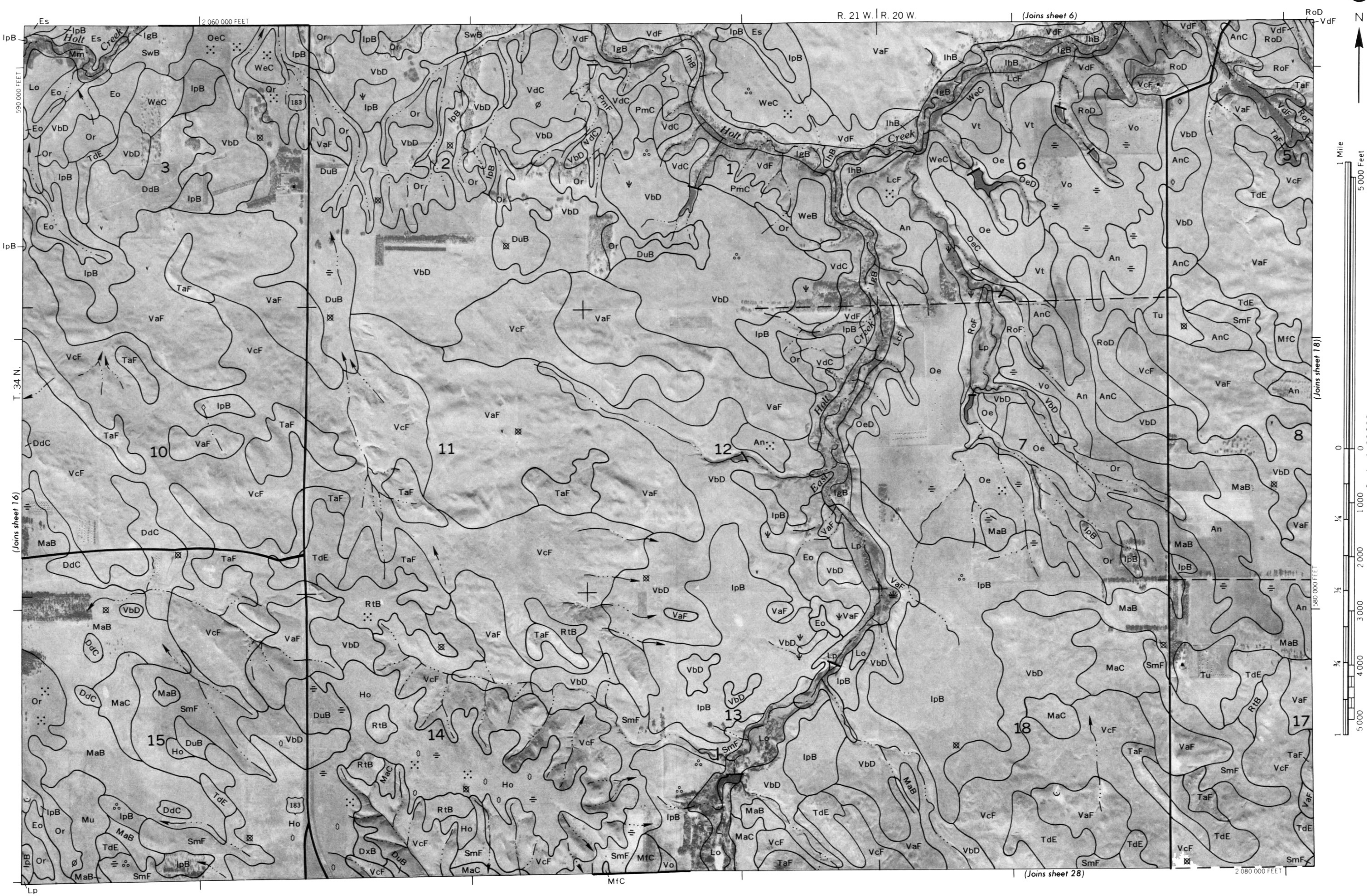


KEYA PAHA COUNTY, NEBRASKA NO. 15

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

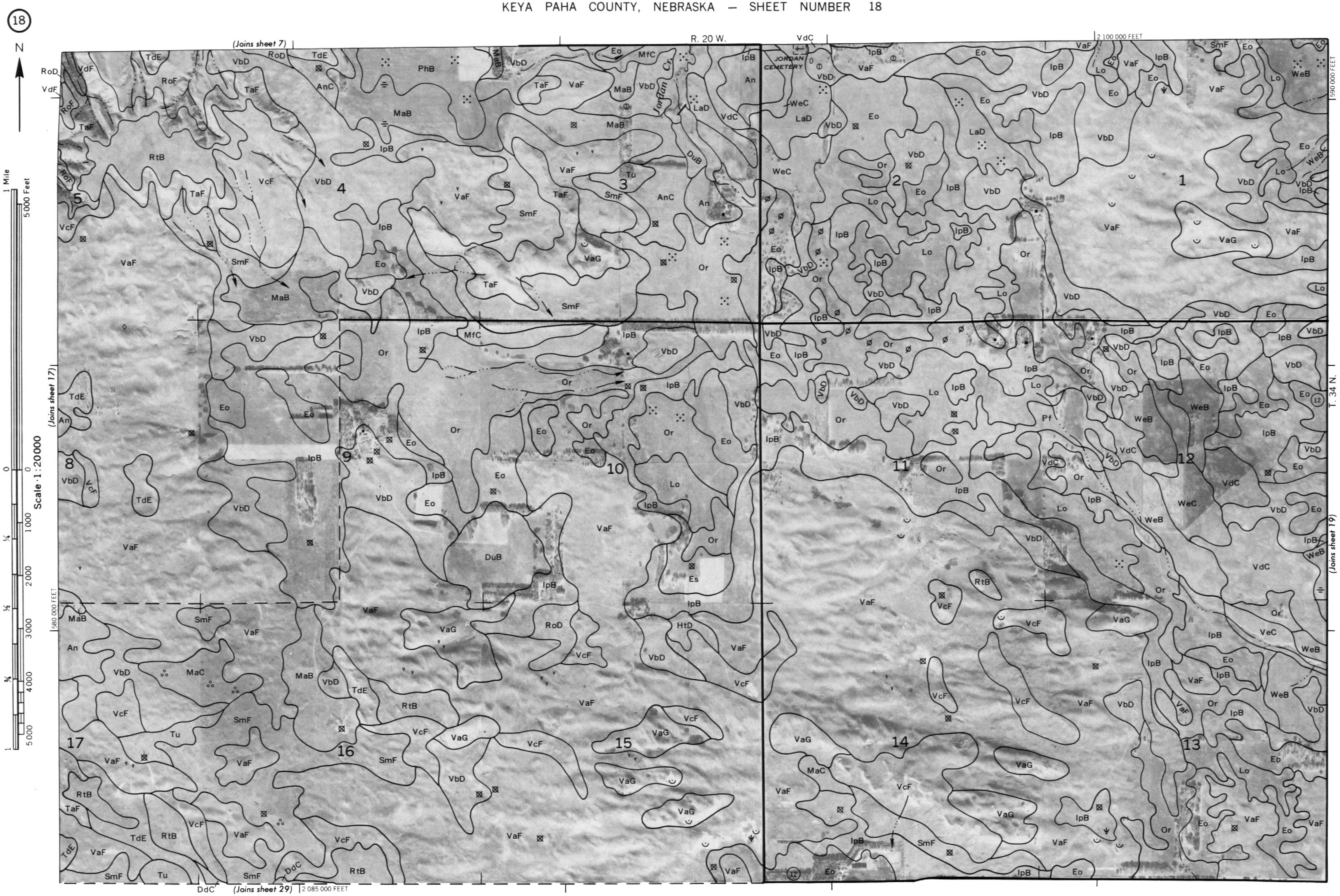
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

KEYA PAHA COUNTY, NEBRASKA NO. 16

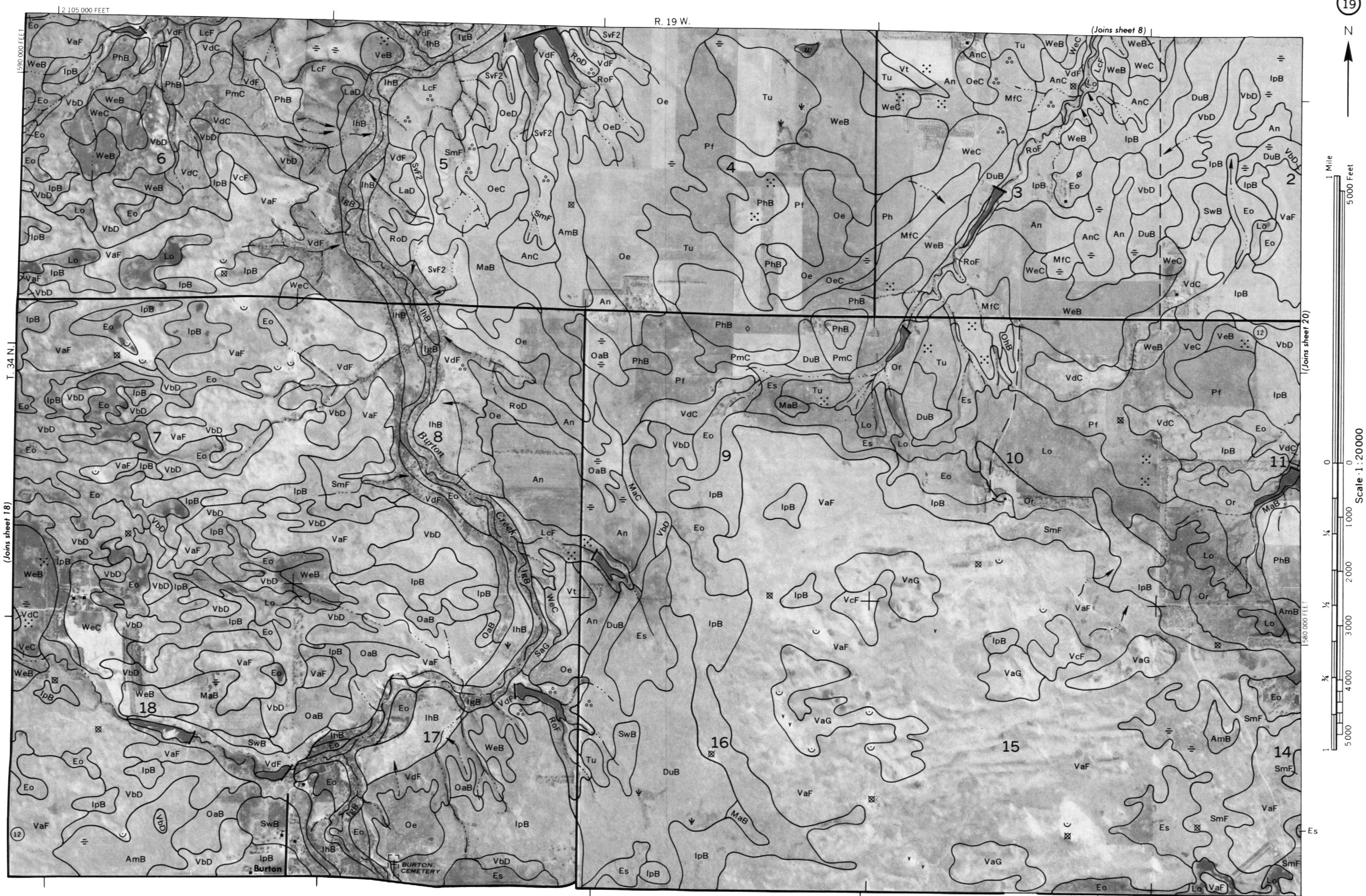


KEYA PAHA COUNTY, NEBRASKA NO. 17

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

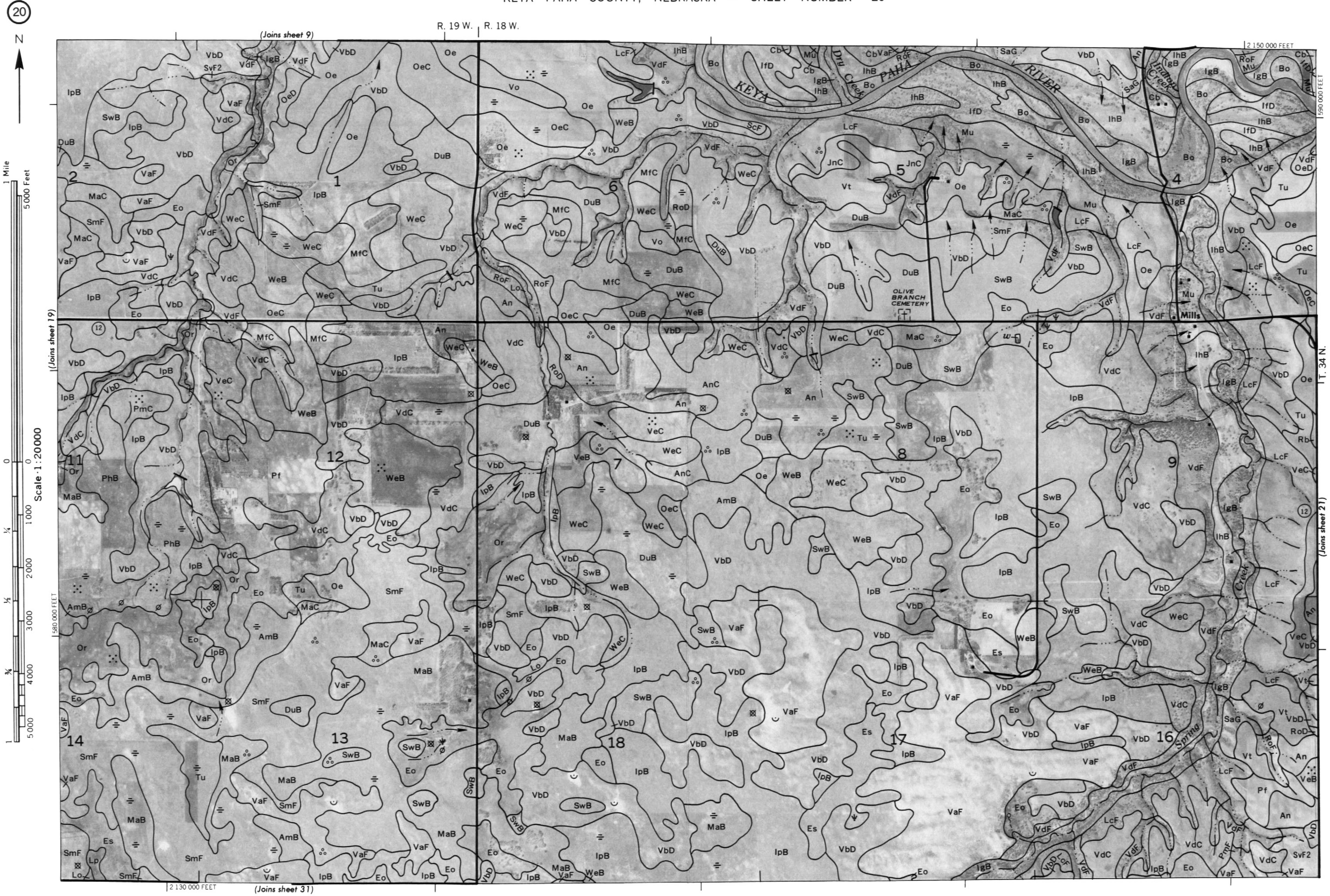


This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



KEYA PAHA COUNTY, NEBRASKA NO. 19

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

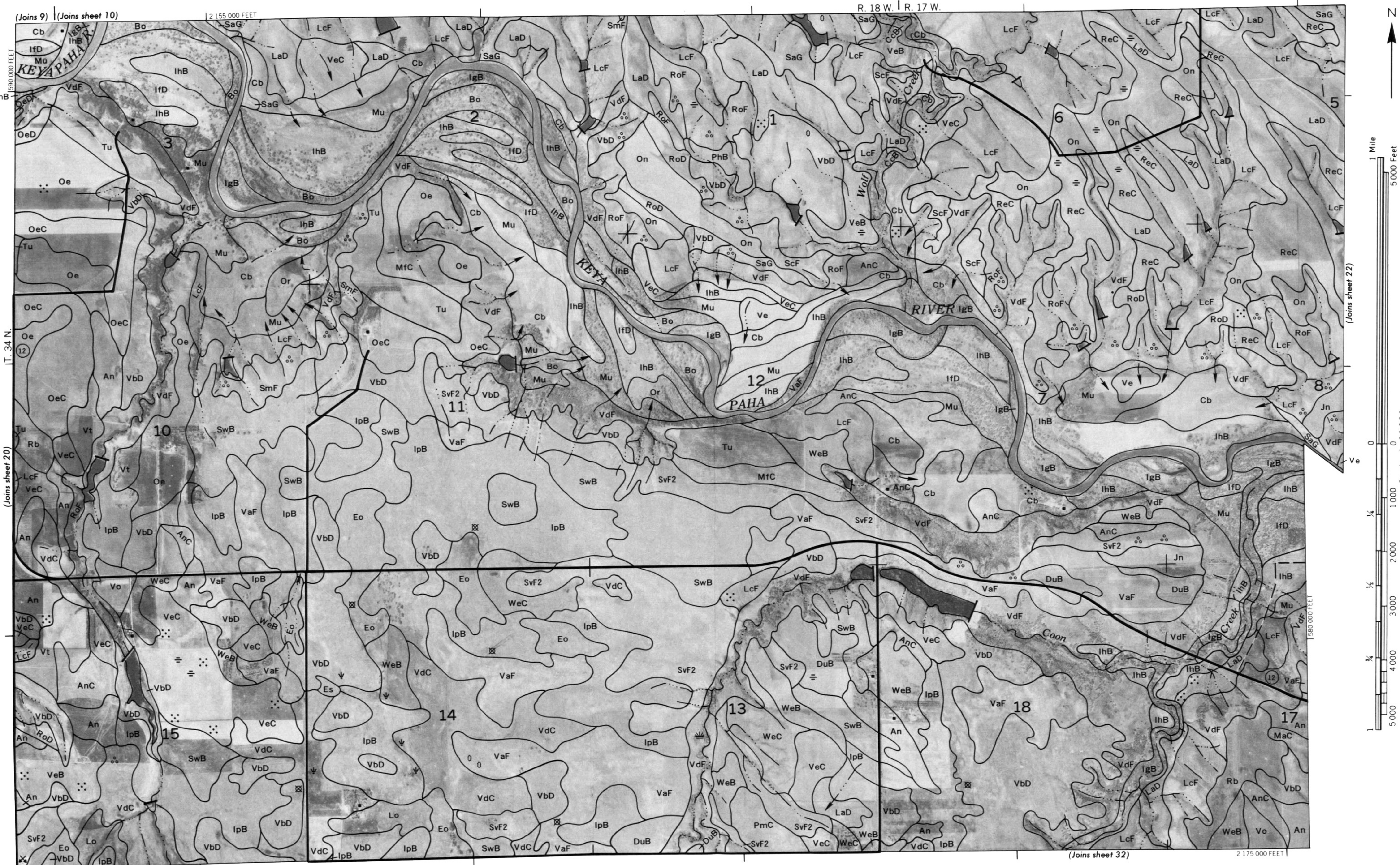


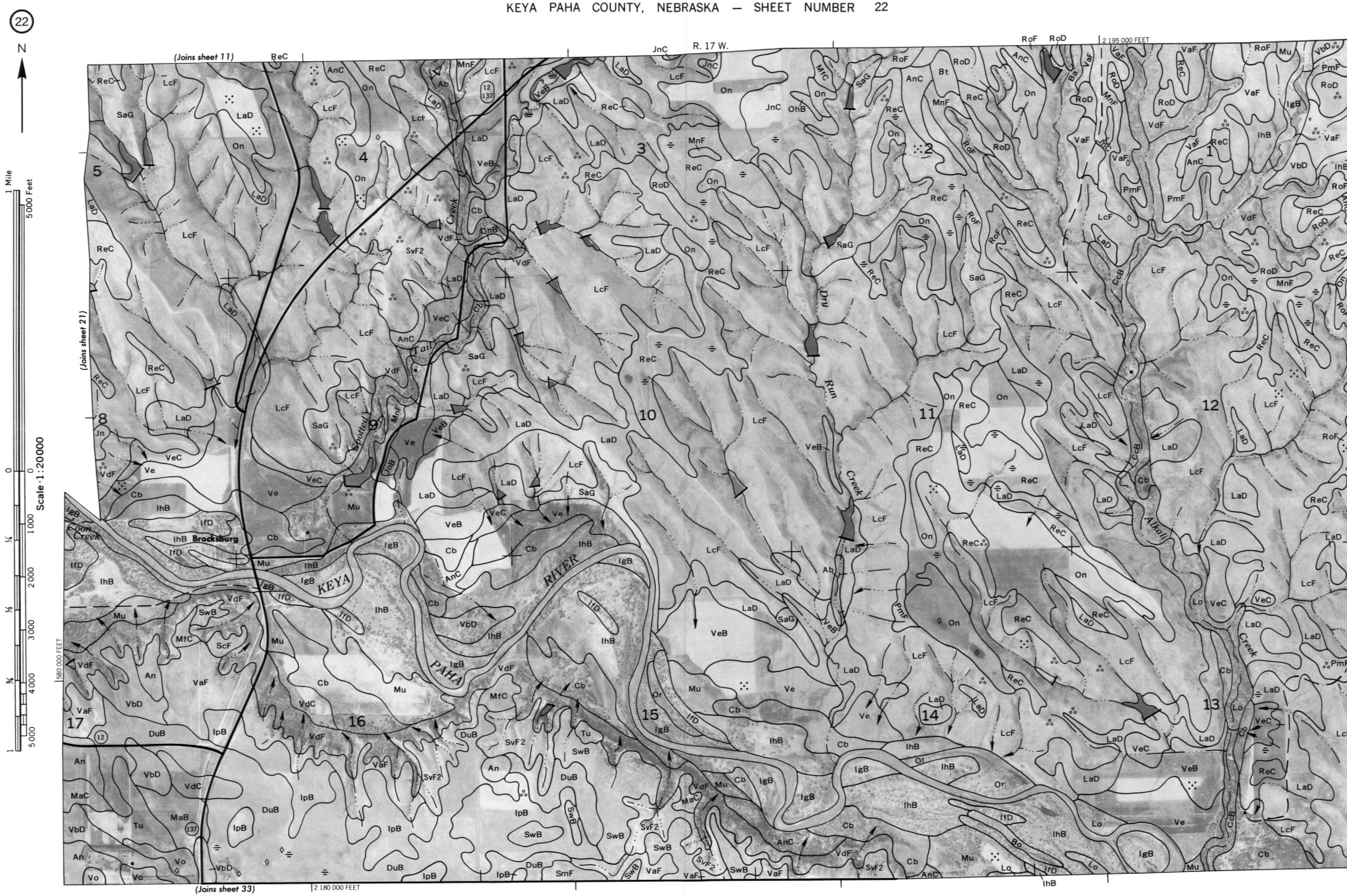
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

KEYA PAHA COUNTY, NEBRASKA NO. 20

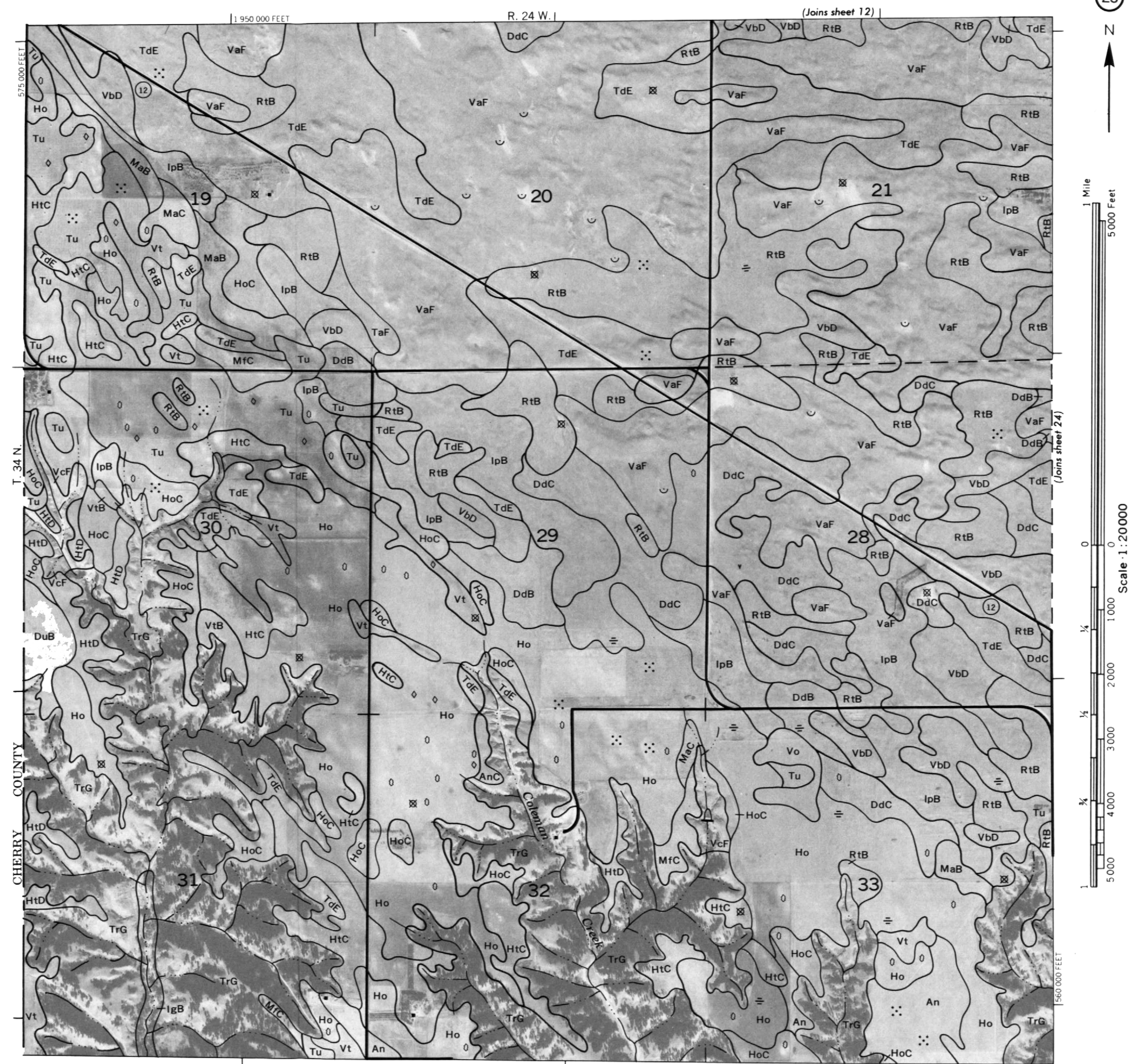
KEYA PAHA COUNTY, NEBRASKA NO. 21

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



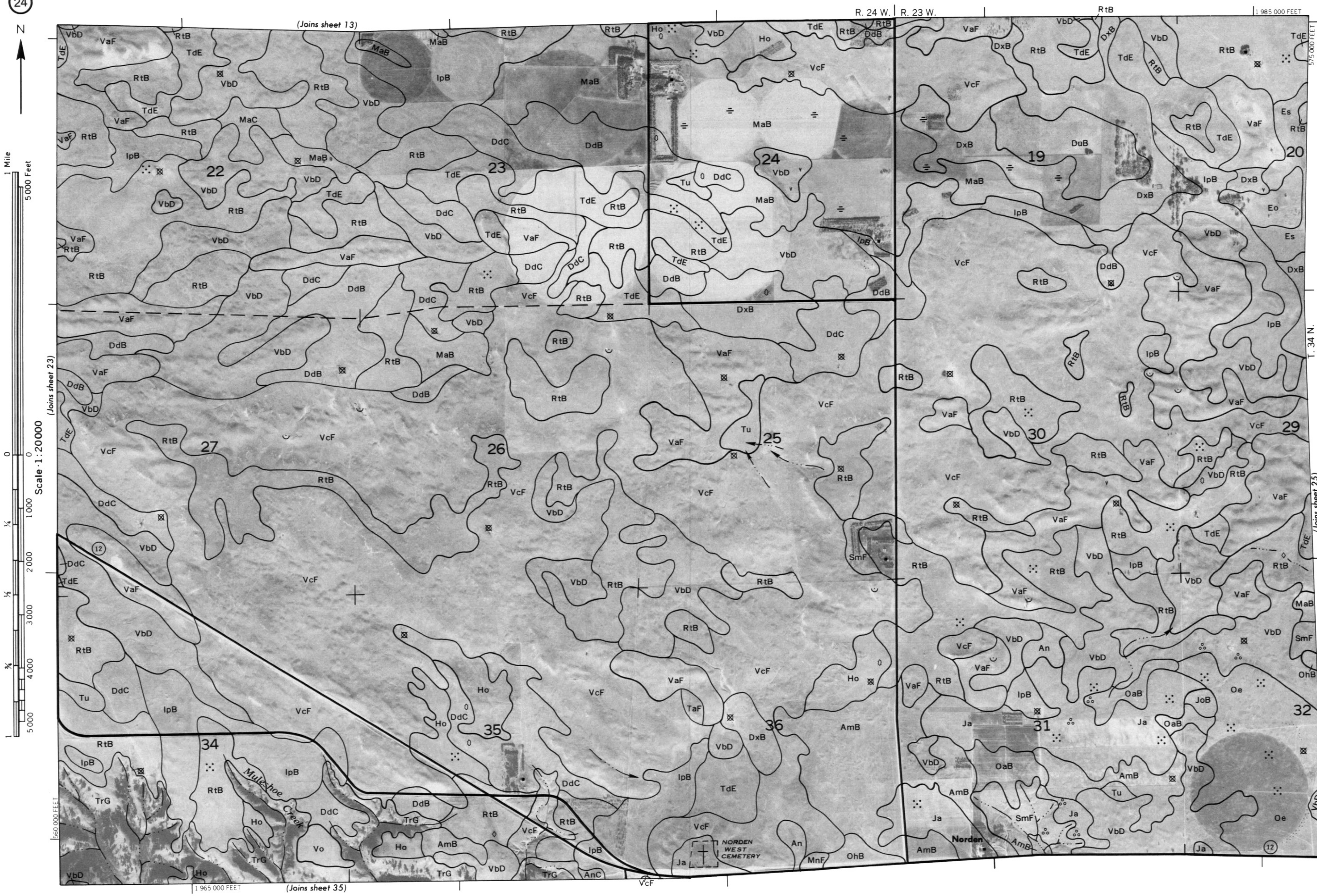


This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



KEYA PAHA COUNTY, NEBRASKA NO. 23

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

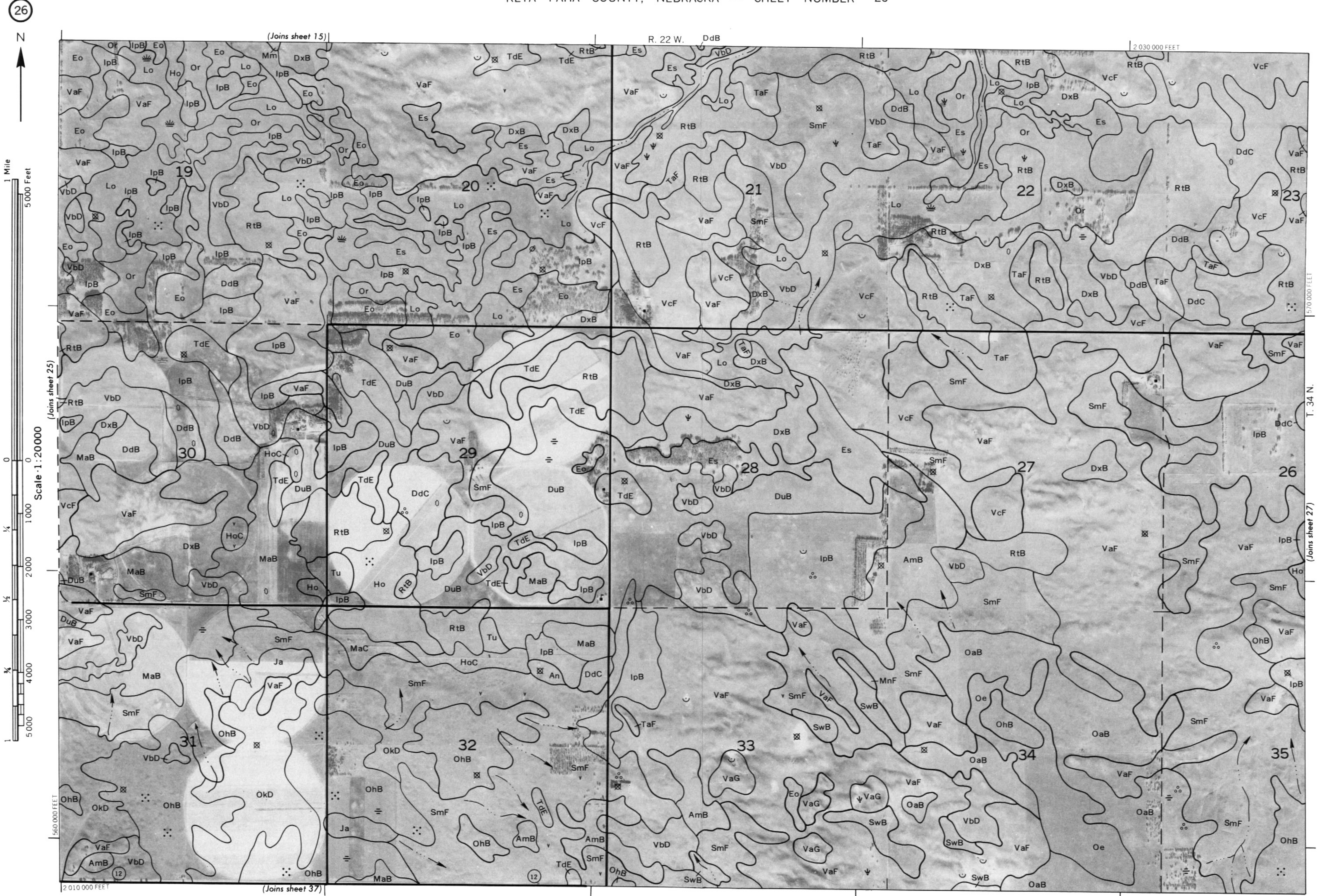


This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

KEYA PAHA COUNTY, NEBRASKA NO. 24

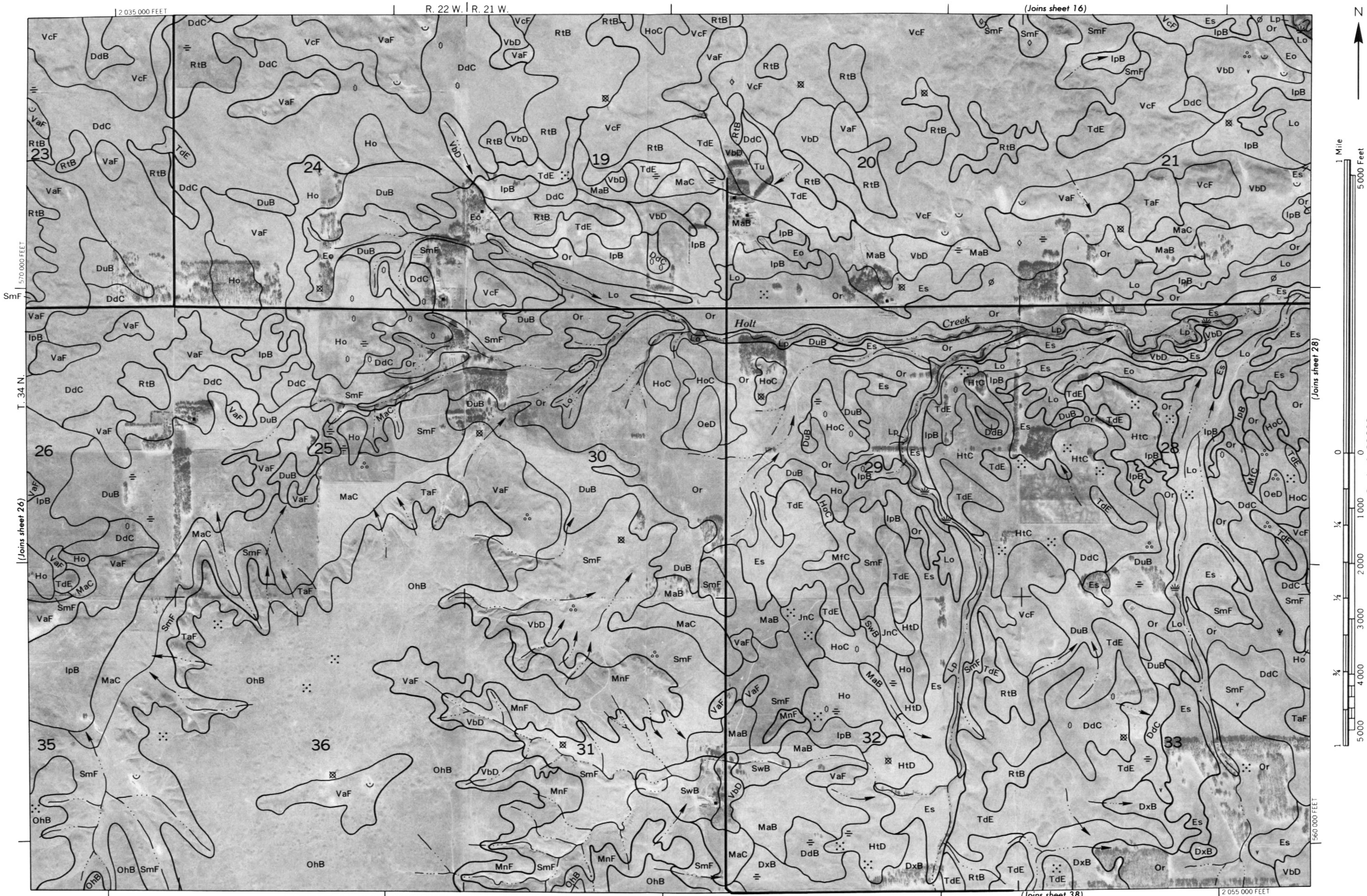
KEYA PAHA COUNTY, NEBRASKA NO. 25

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



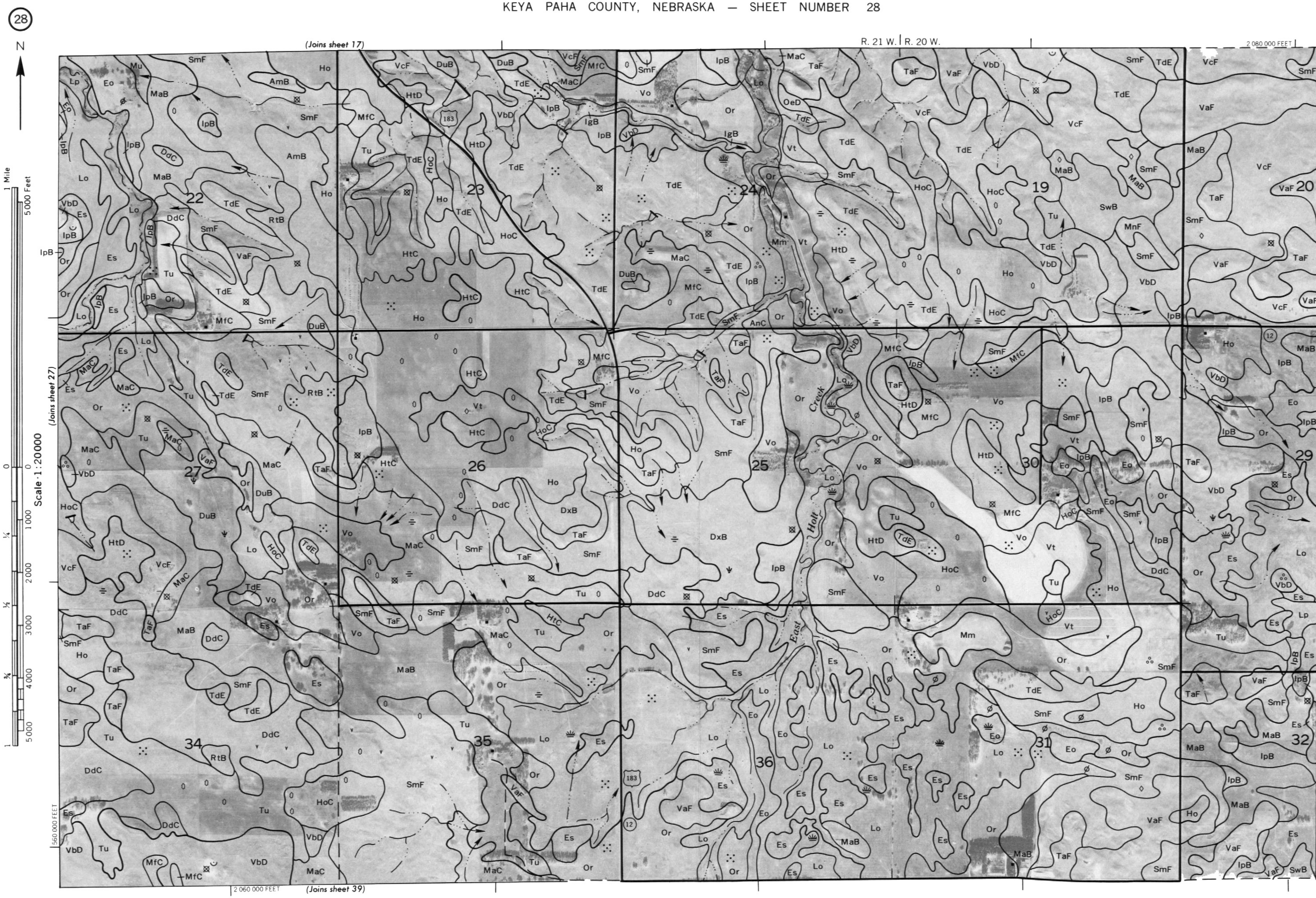
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

KEYA PAHA COUNTY, NEBRASKA NO. 26



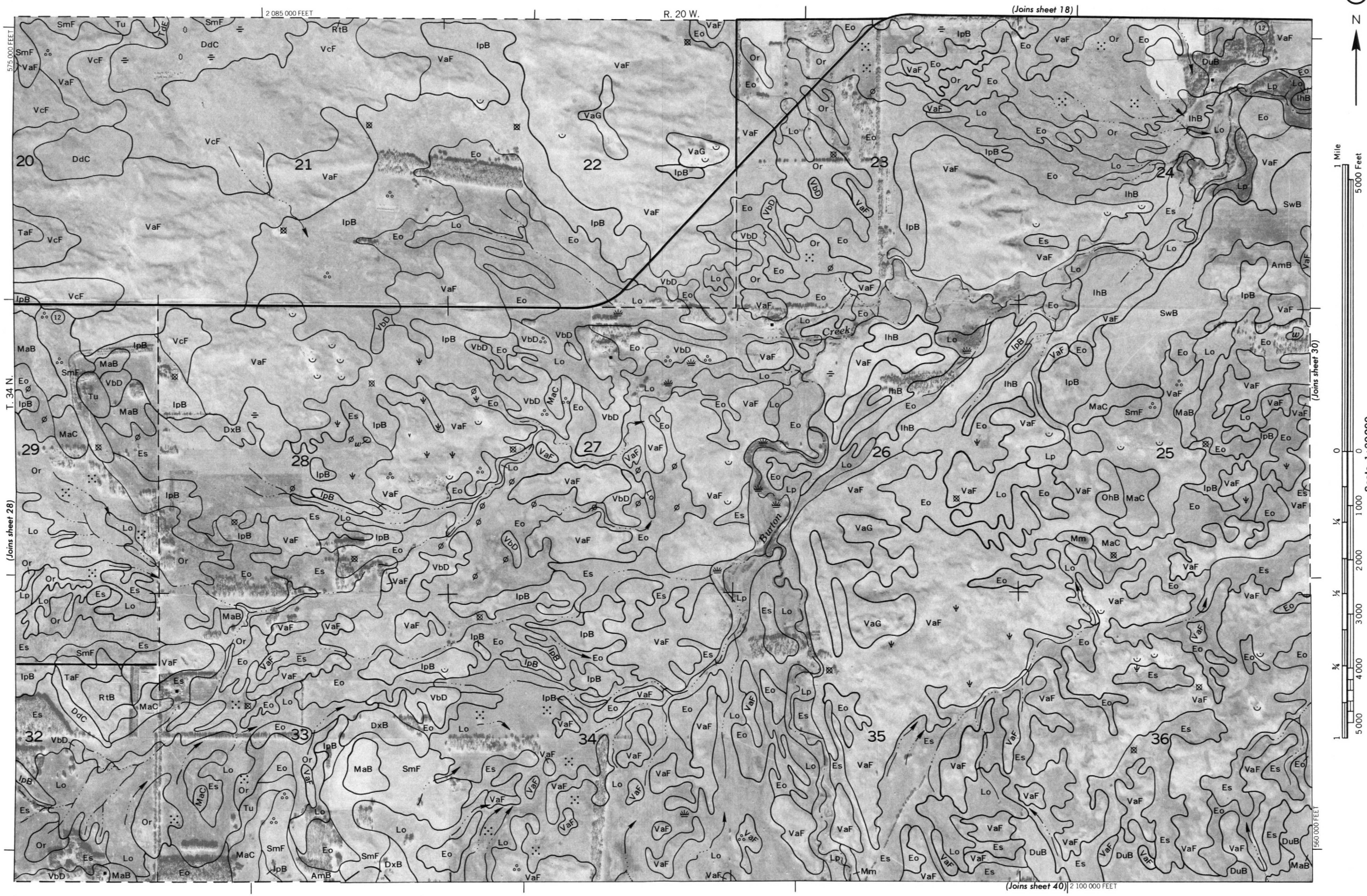
KEYA PAHA COUNTY, NEBRASKA NO. 27

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



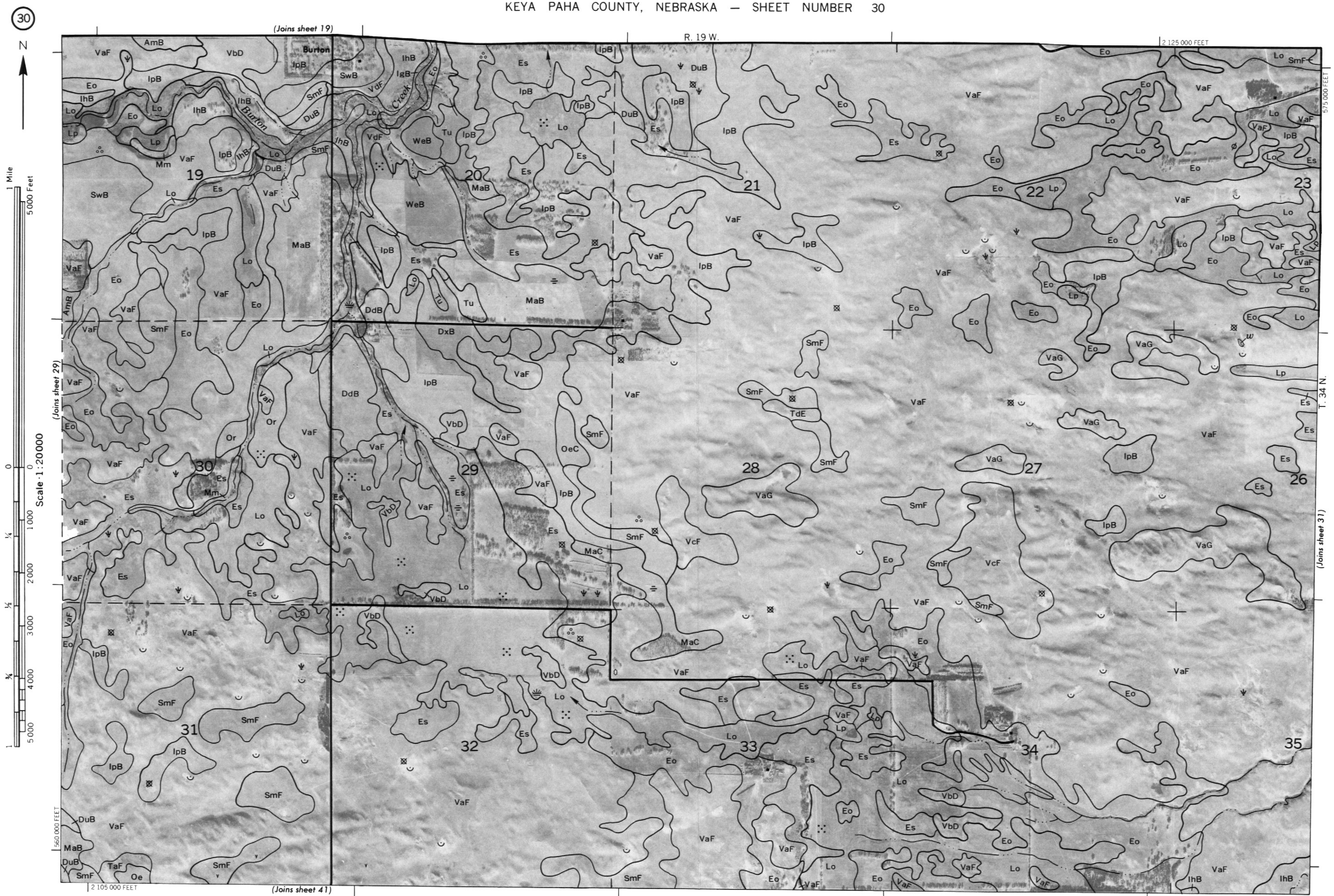
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

29



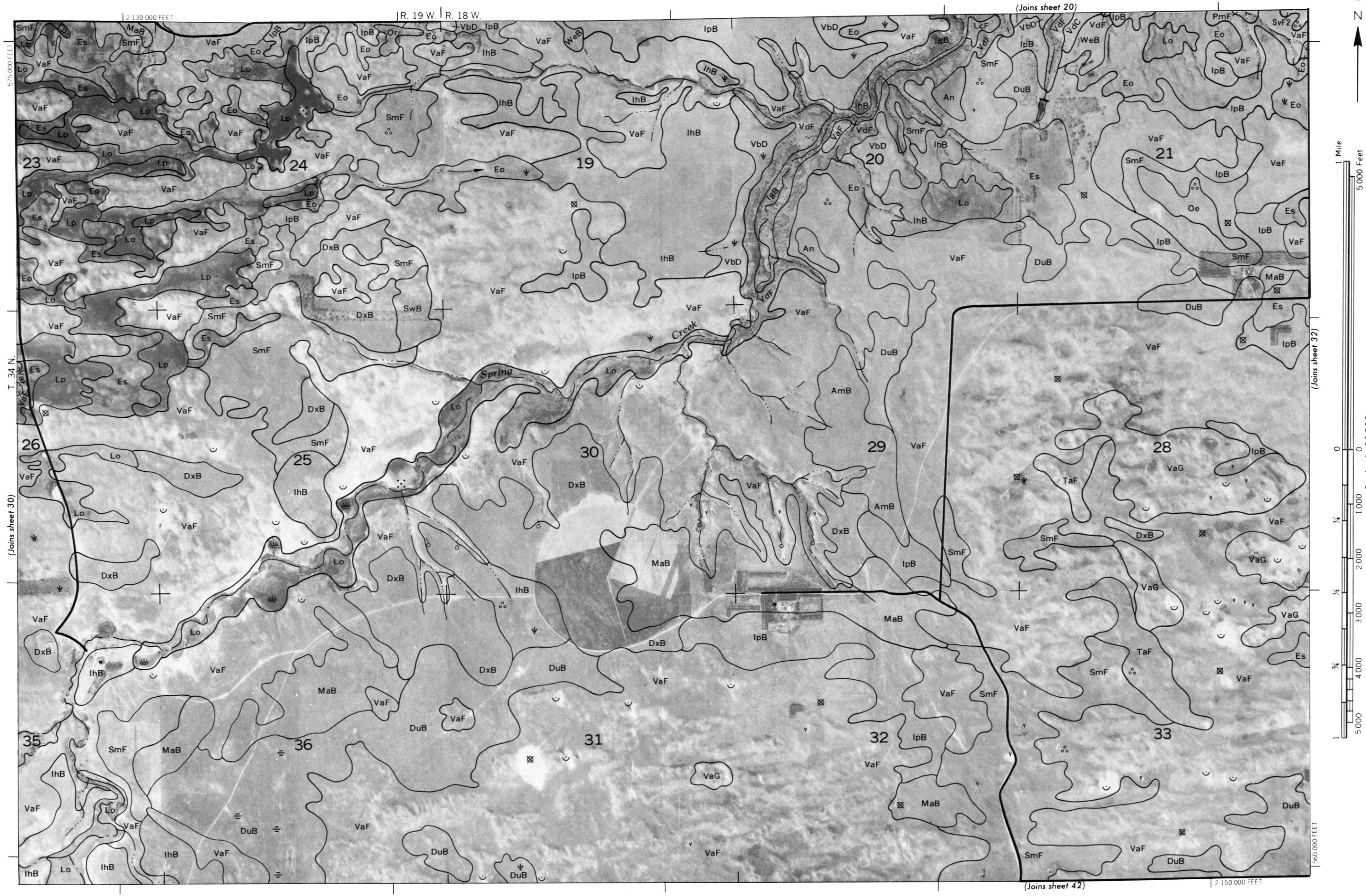
KEYA PAHA COUNTY, NEBRASKA NO. 29

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



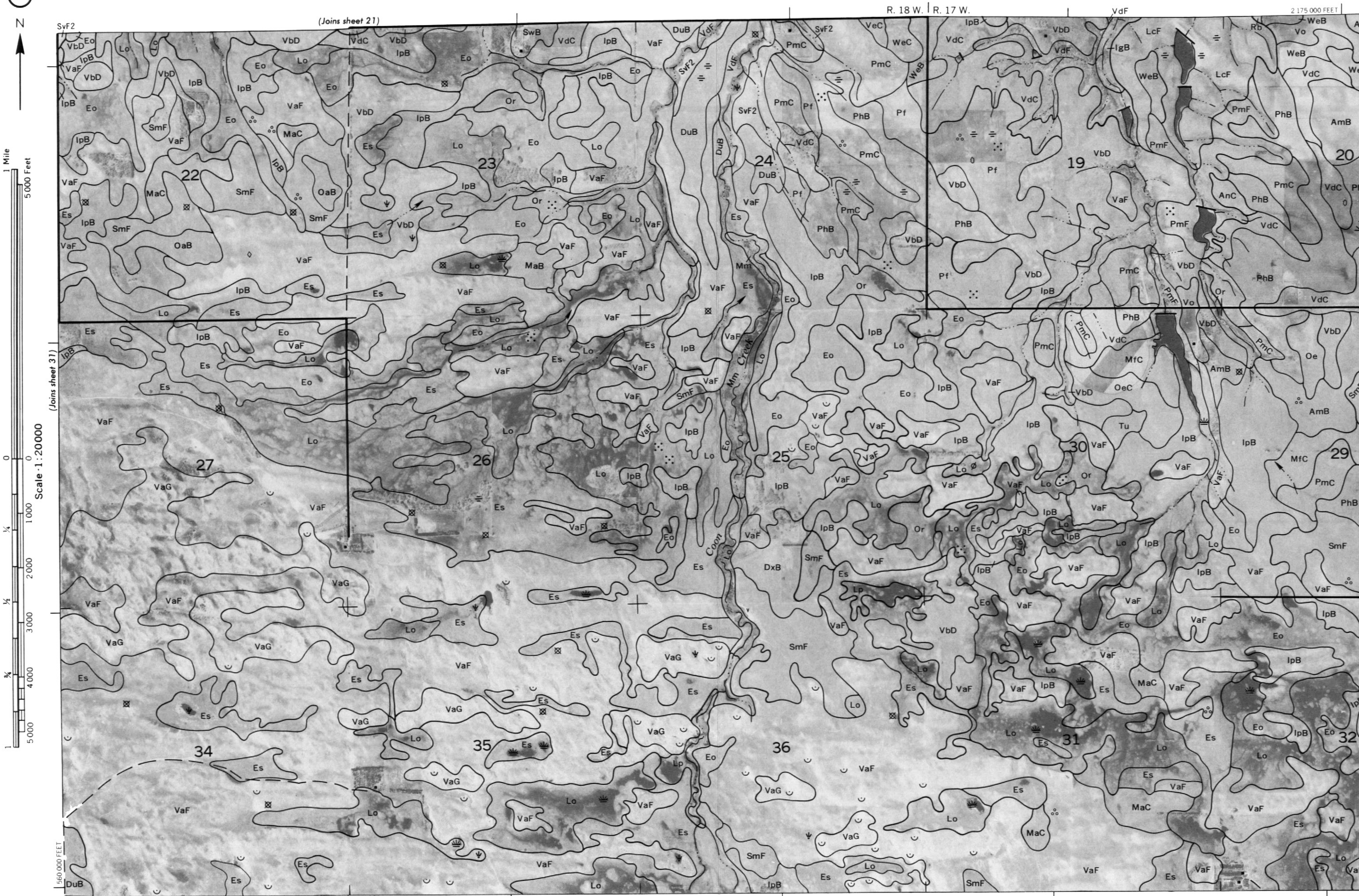
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

KEYA PAHA COUNTY, NEBRASKA NO. 30

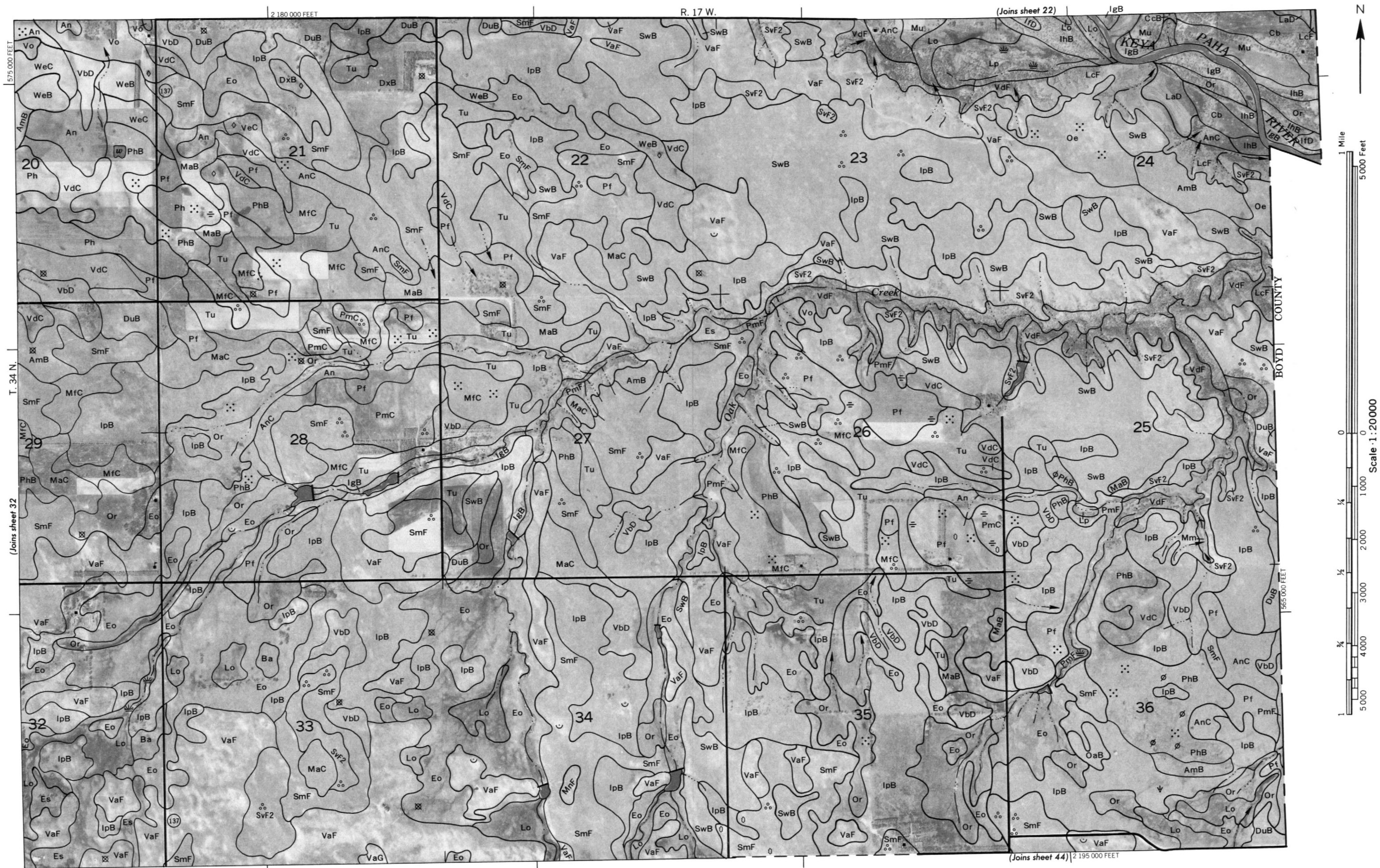


KEYA PAHA COUNTY, NEBRASKA NO. 31

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



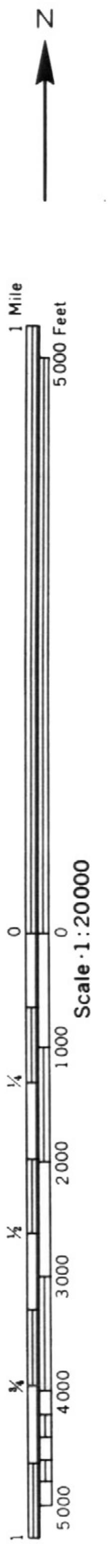
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

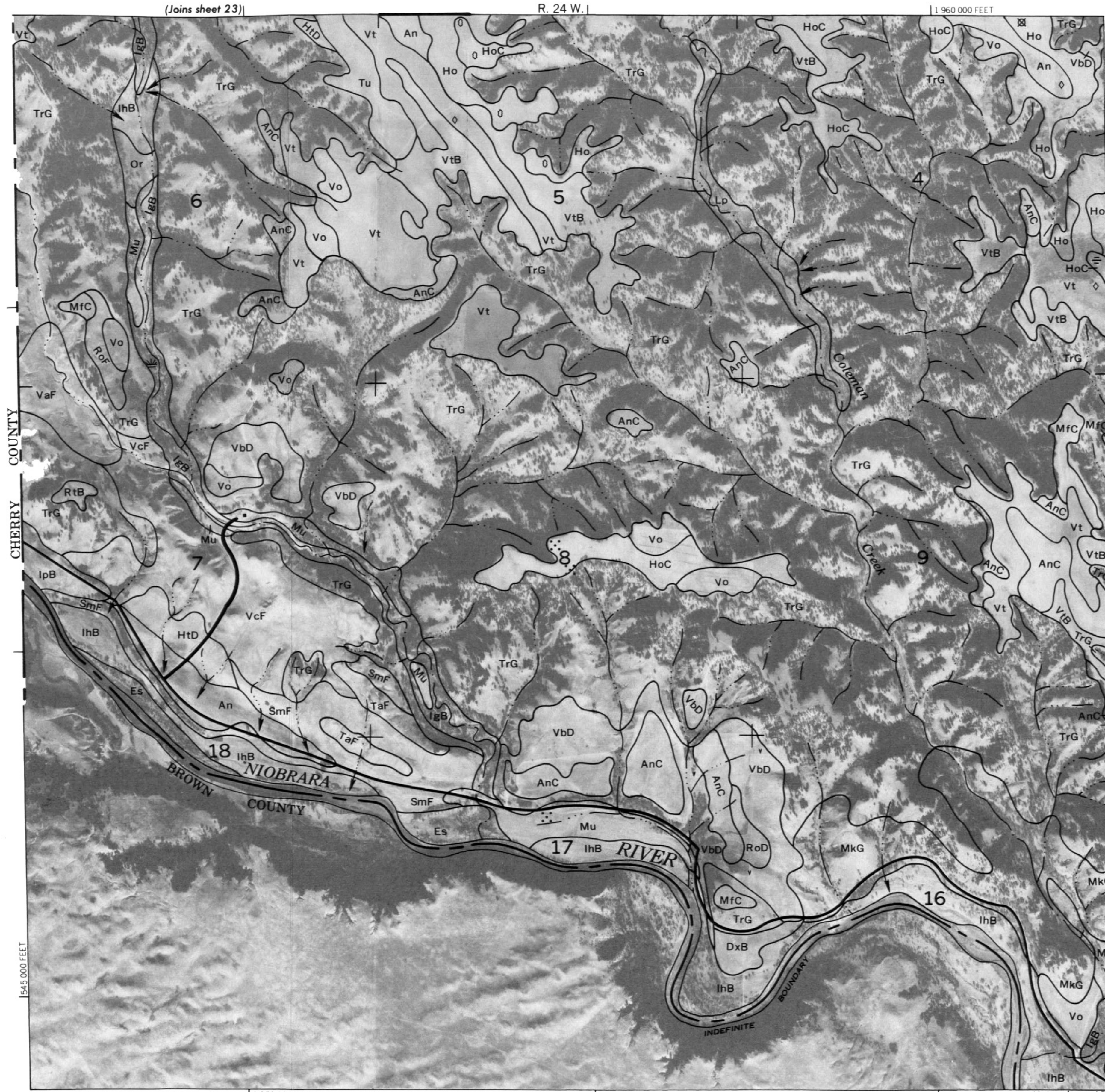


KEYA PAHA COUNTY, NEBRASKA NO. 33

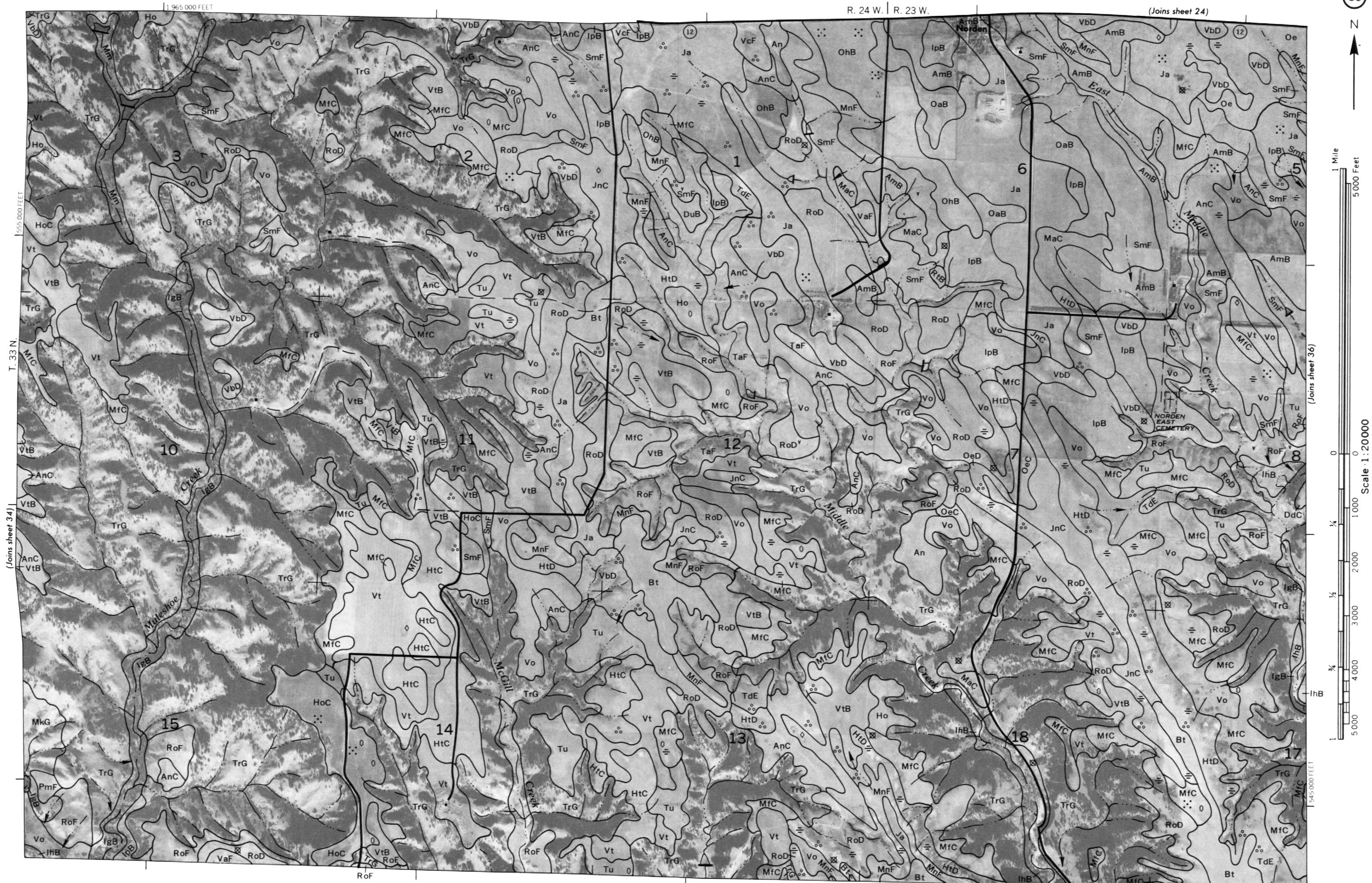
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

KEYA PAHA COUNTY, NEBRASKA — SHEET NUMBER 34

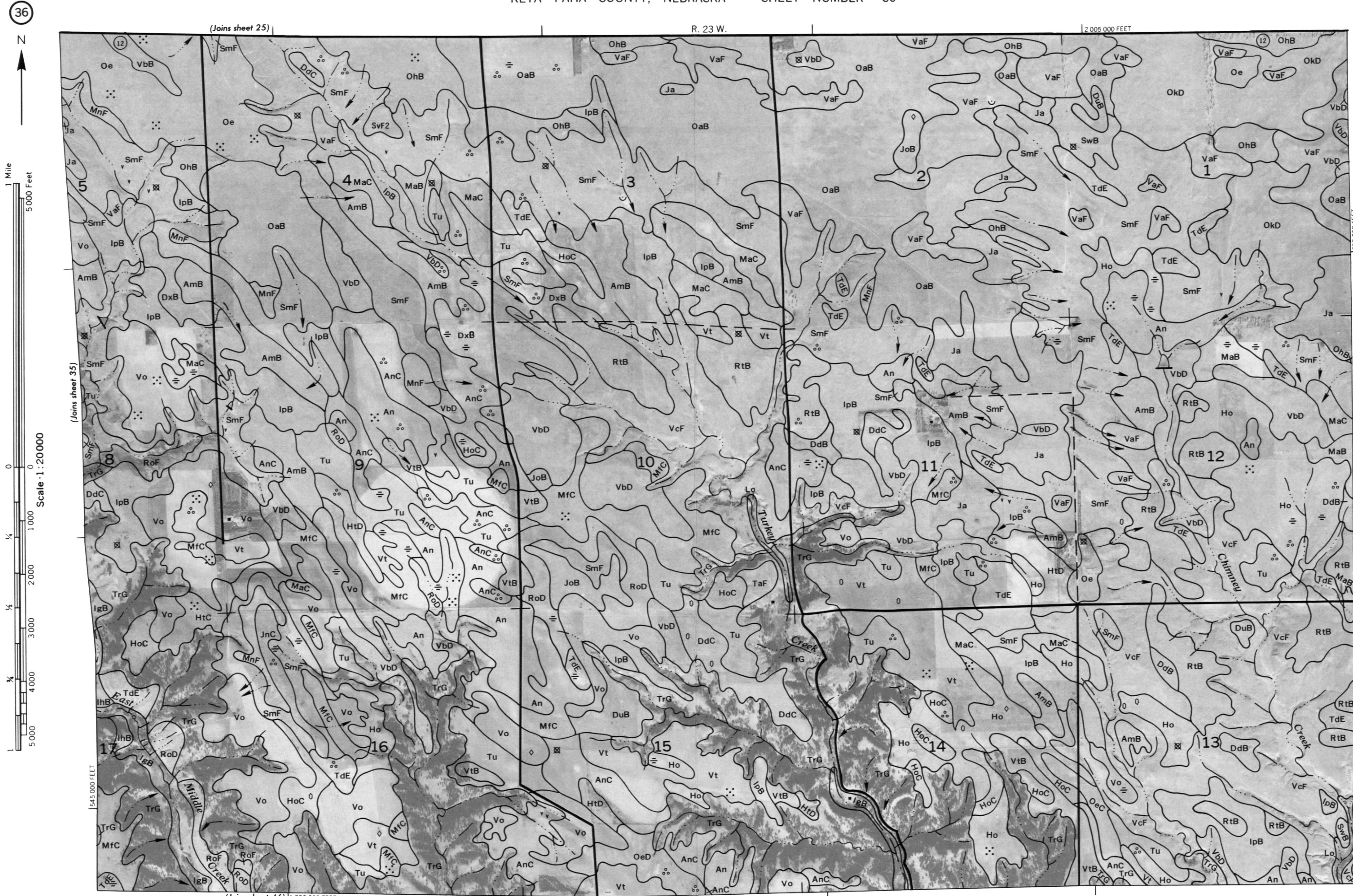




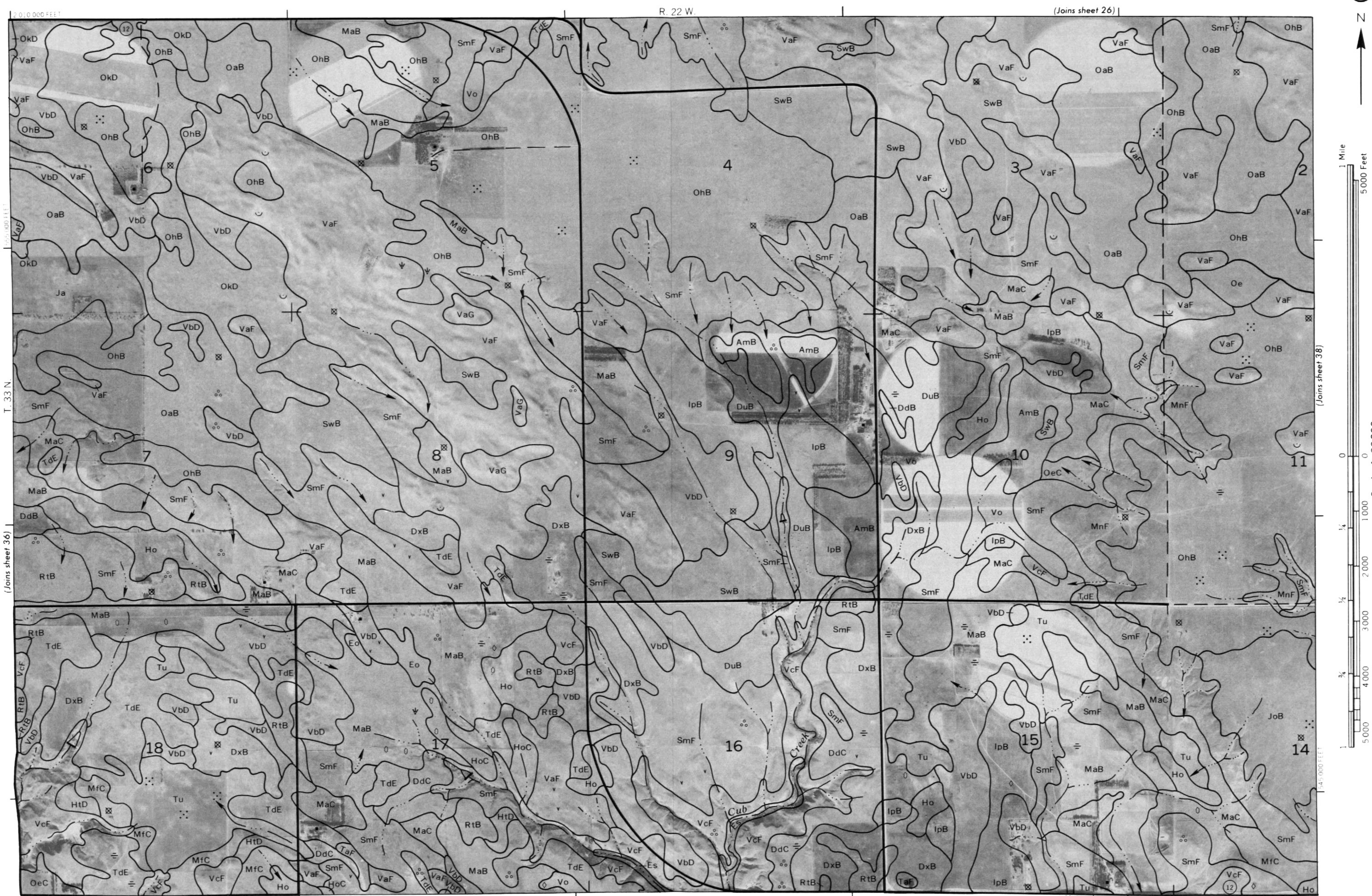
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



KEYA PAHA COUNTY, NEBRASKA NO. 37

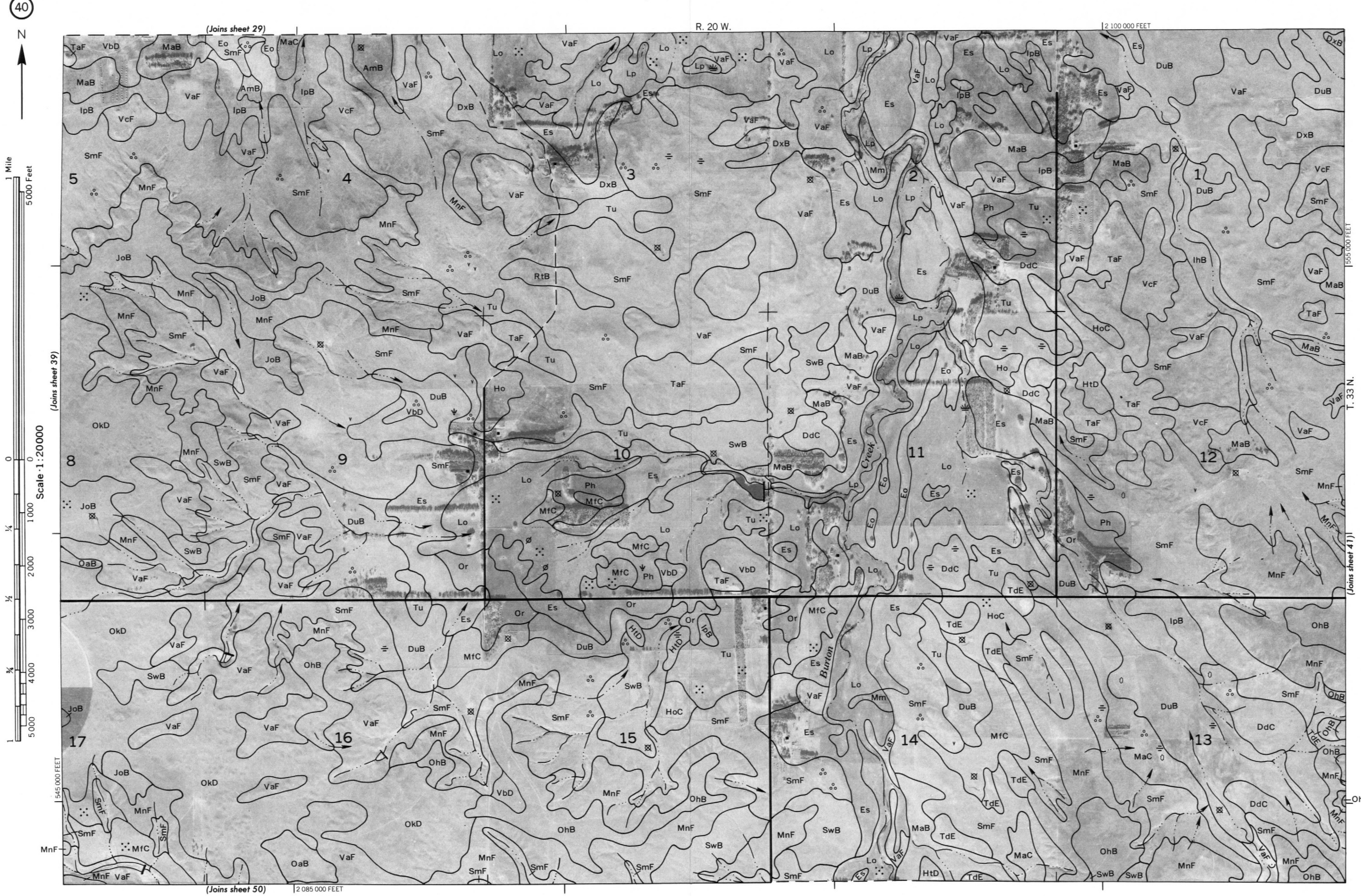
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

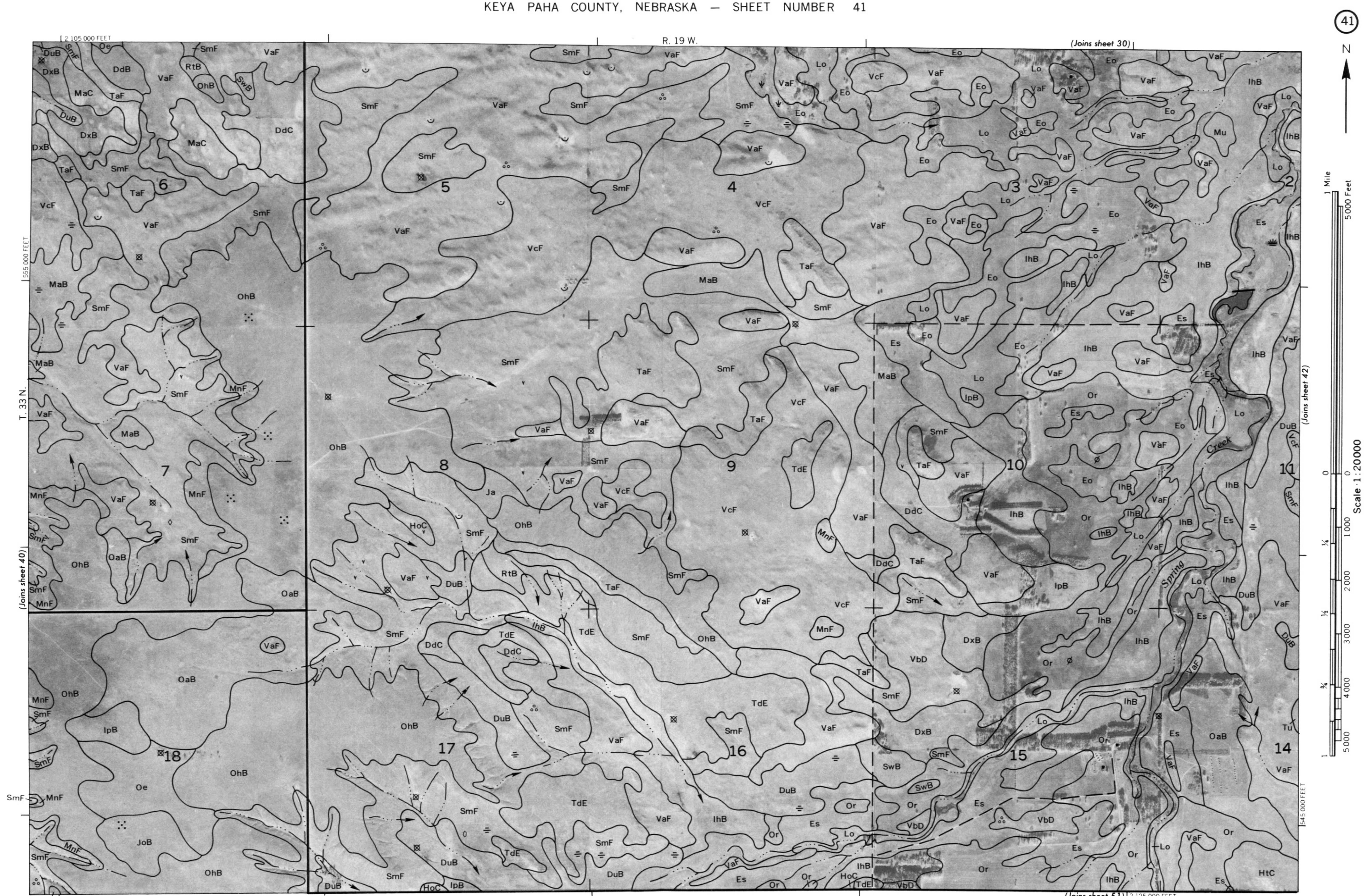
KEYA PAHA COUNTY, NEBRASKA NO. 38

39

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

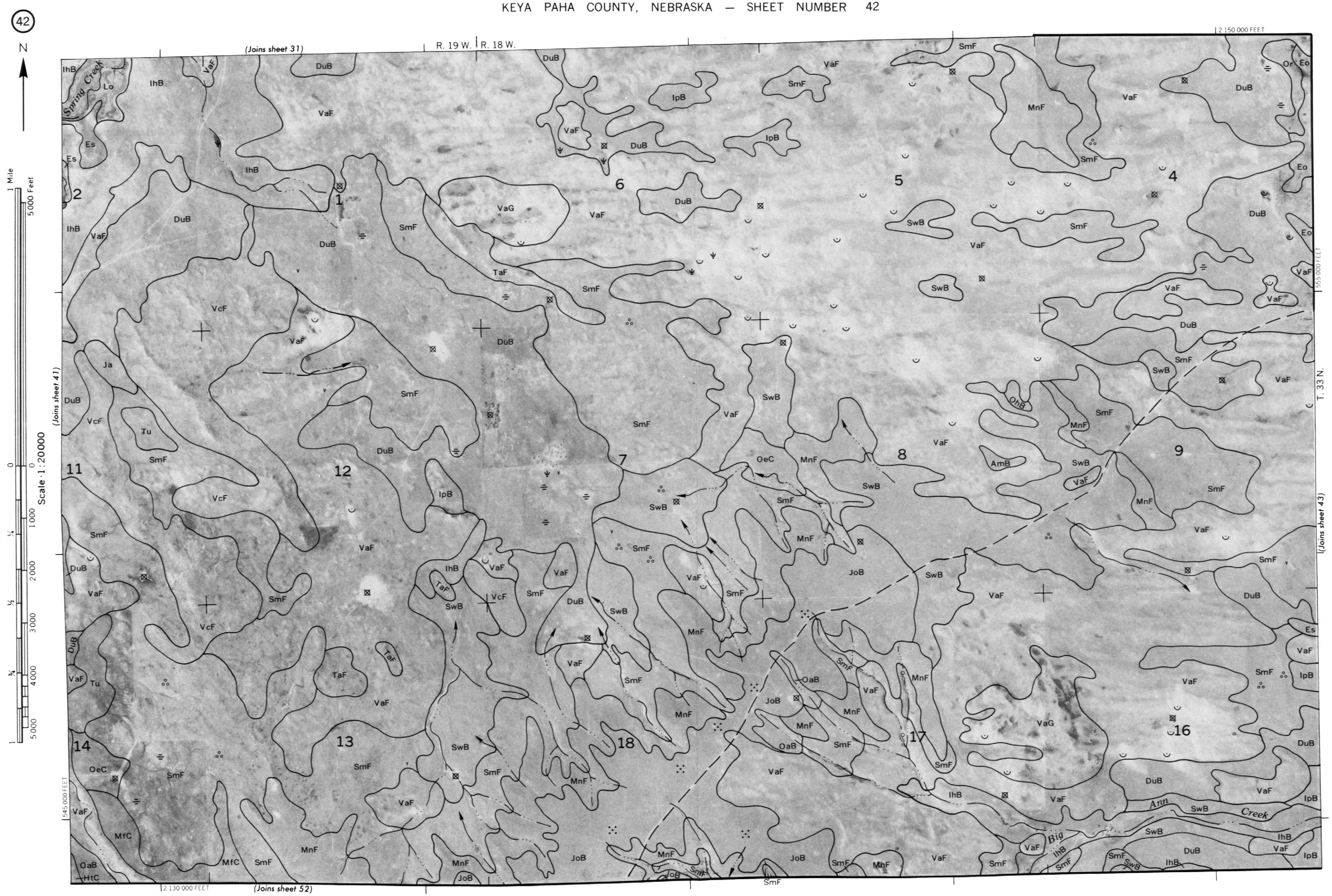


This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



KEYA PAHA COUNTY, NEBRASKA NO. 41

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



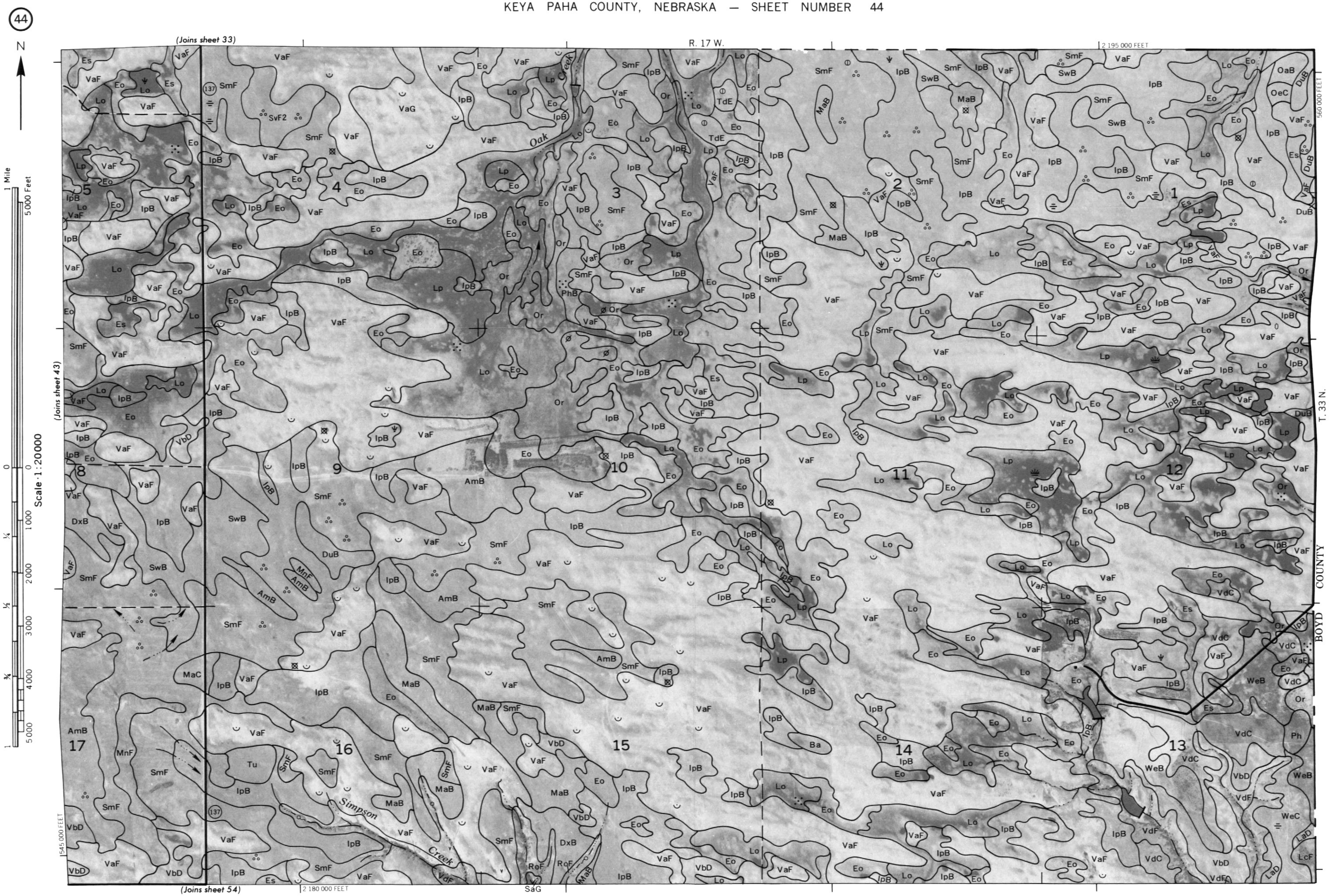
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

KEYA PAHA COUNTY, NEBRASKA NO. 42

43

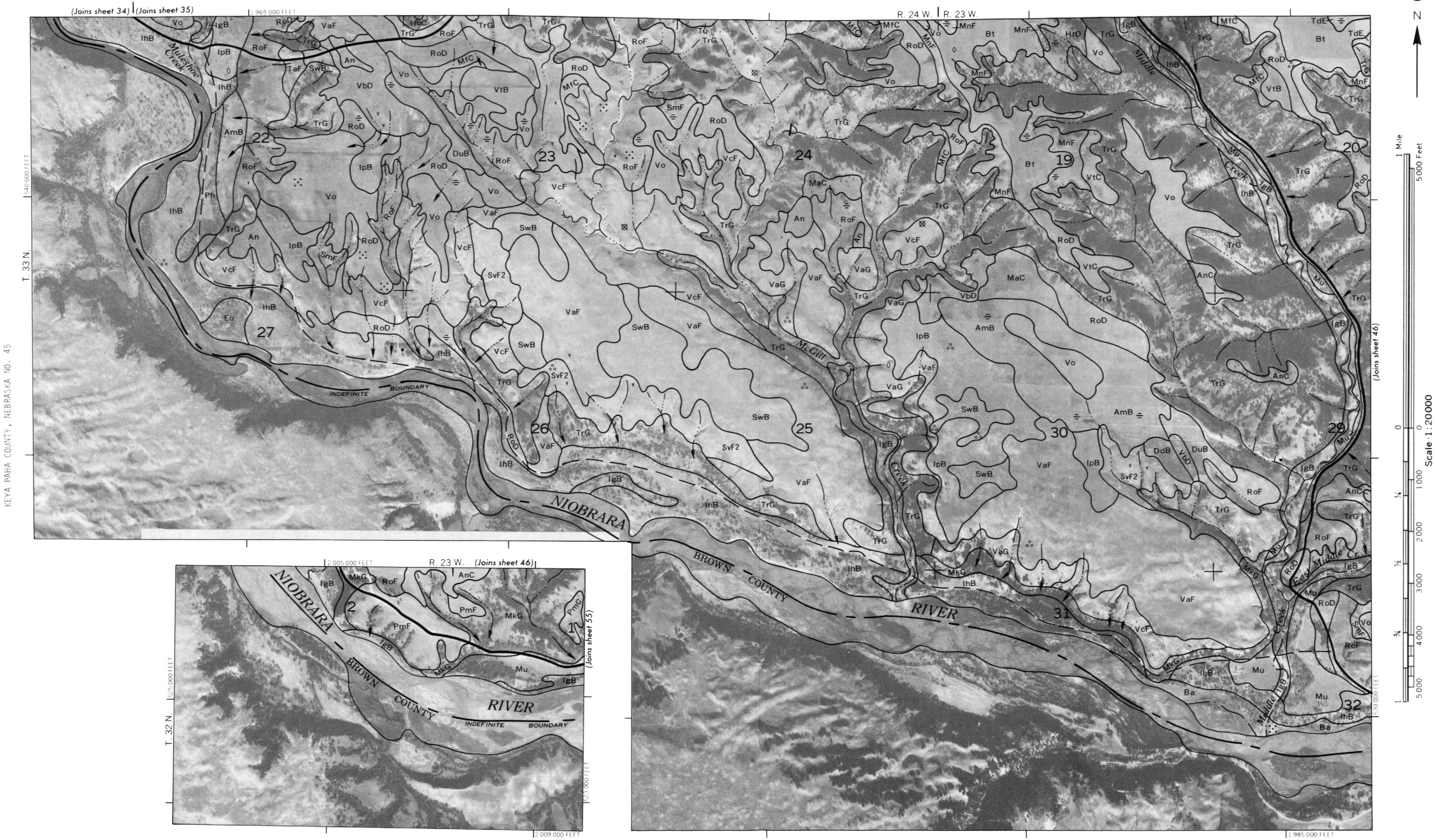
KEYA PAHA COUNTY, NEBRASKA NO. 43

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

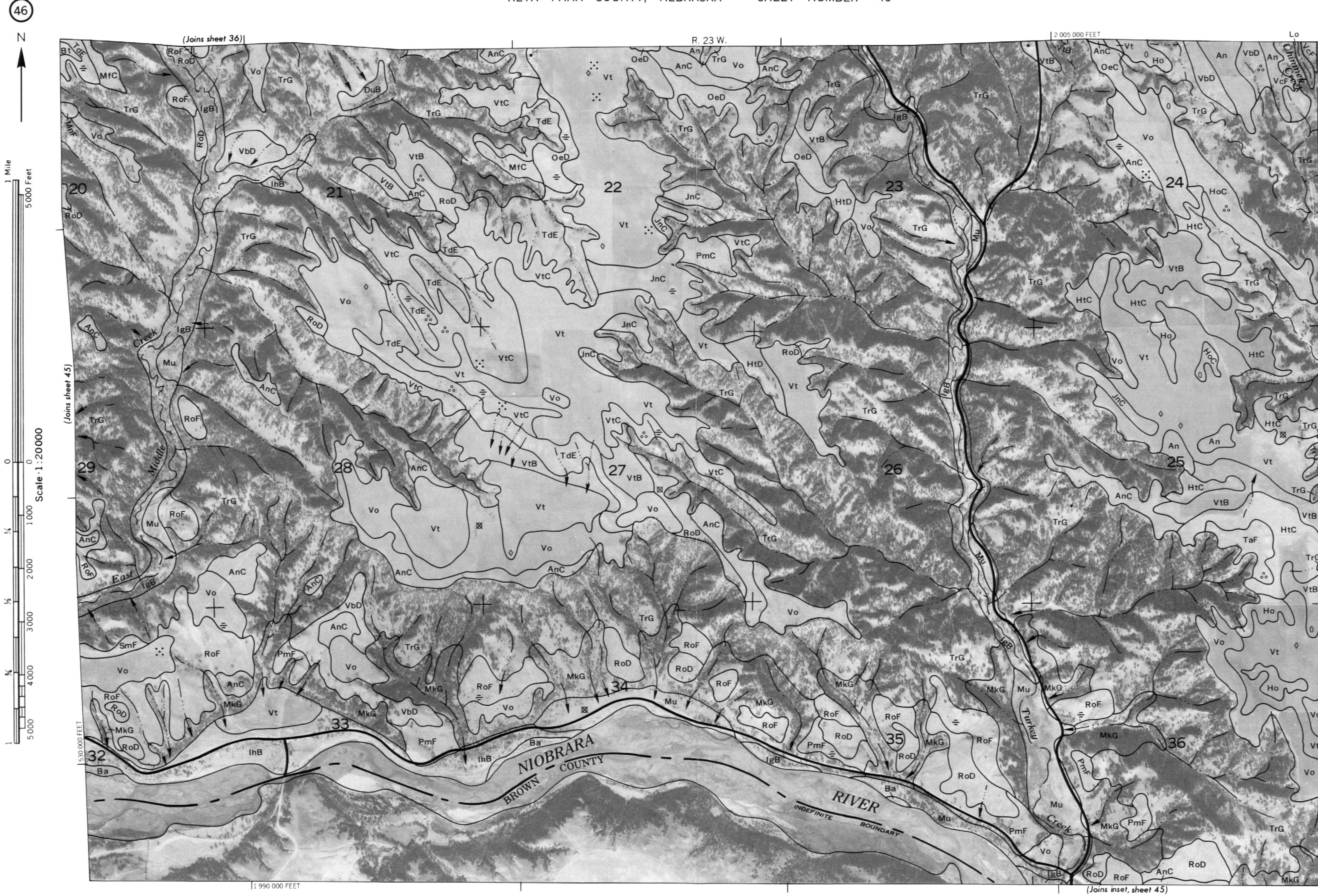


This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

KEYA PAHA COUNTY, NEBRASKA NO. 44

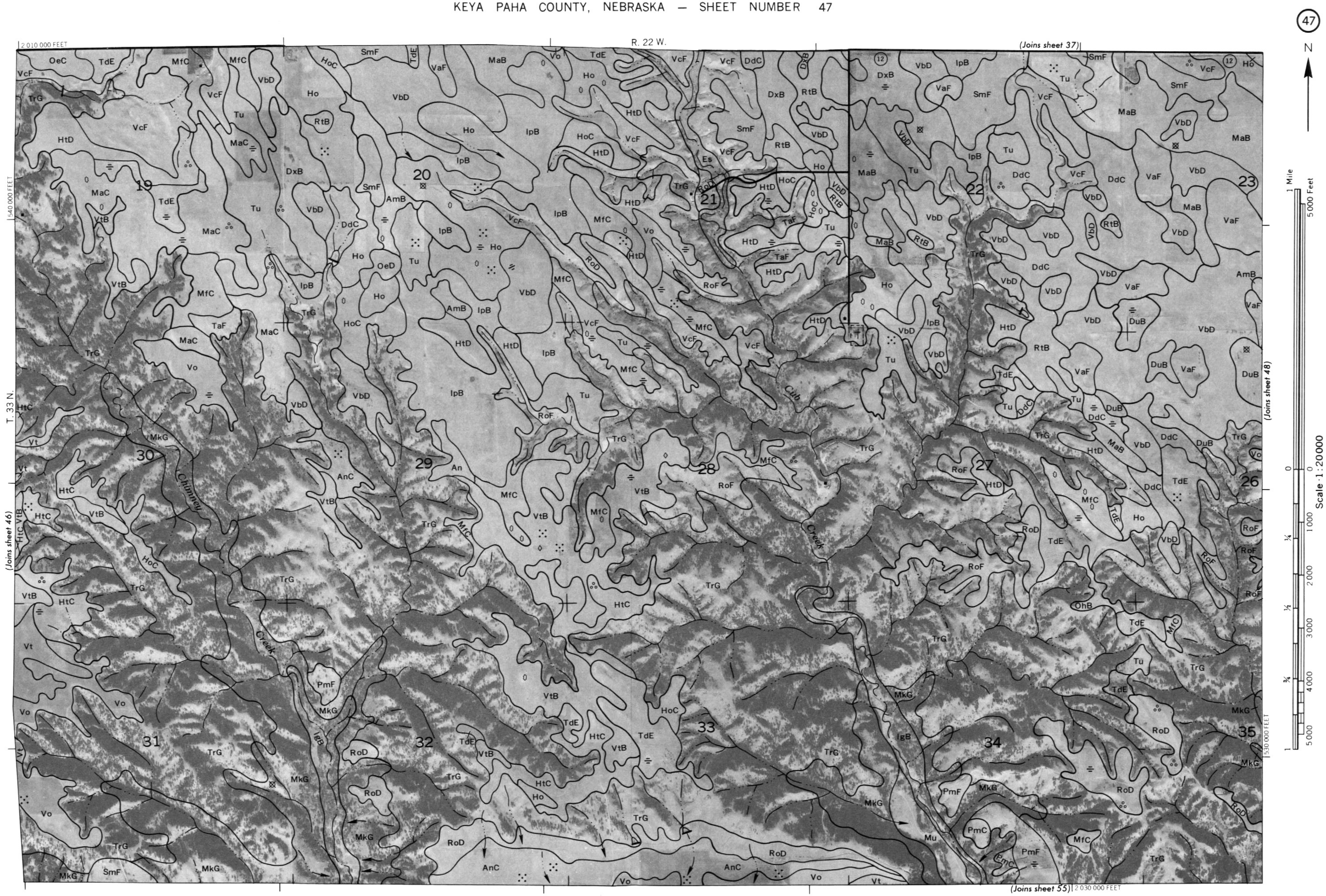


2000 AND 4000-FOOT GRID TICKS



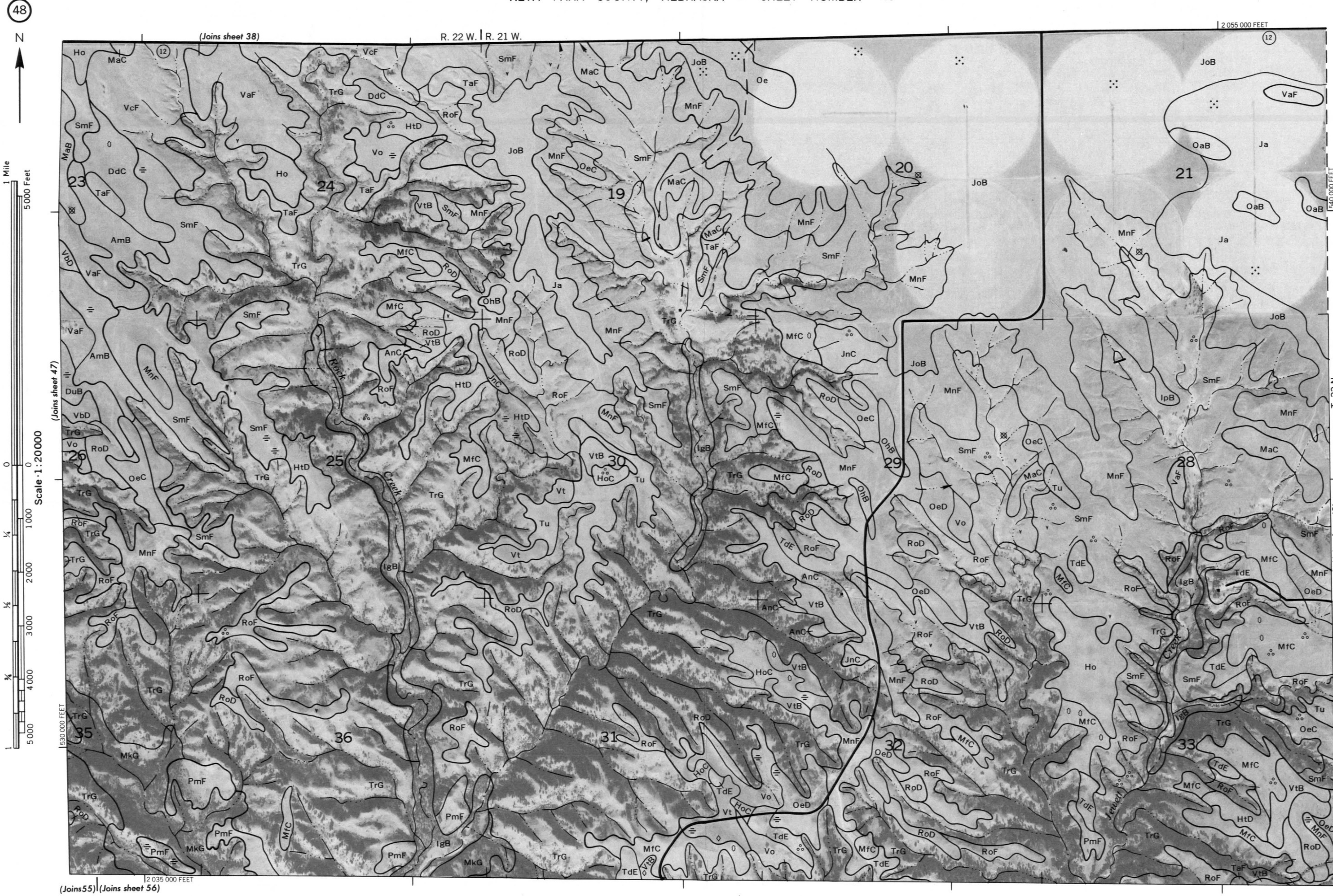
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

KEYA PAHA COUNTY, NEBRASKA NO. 46

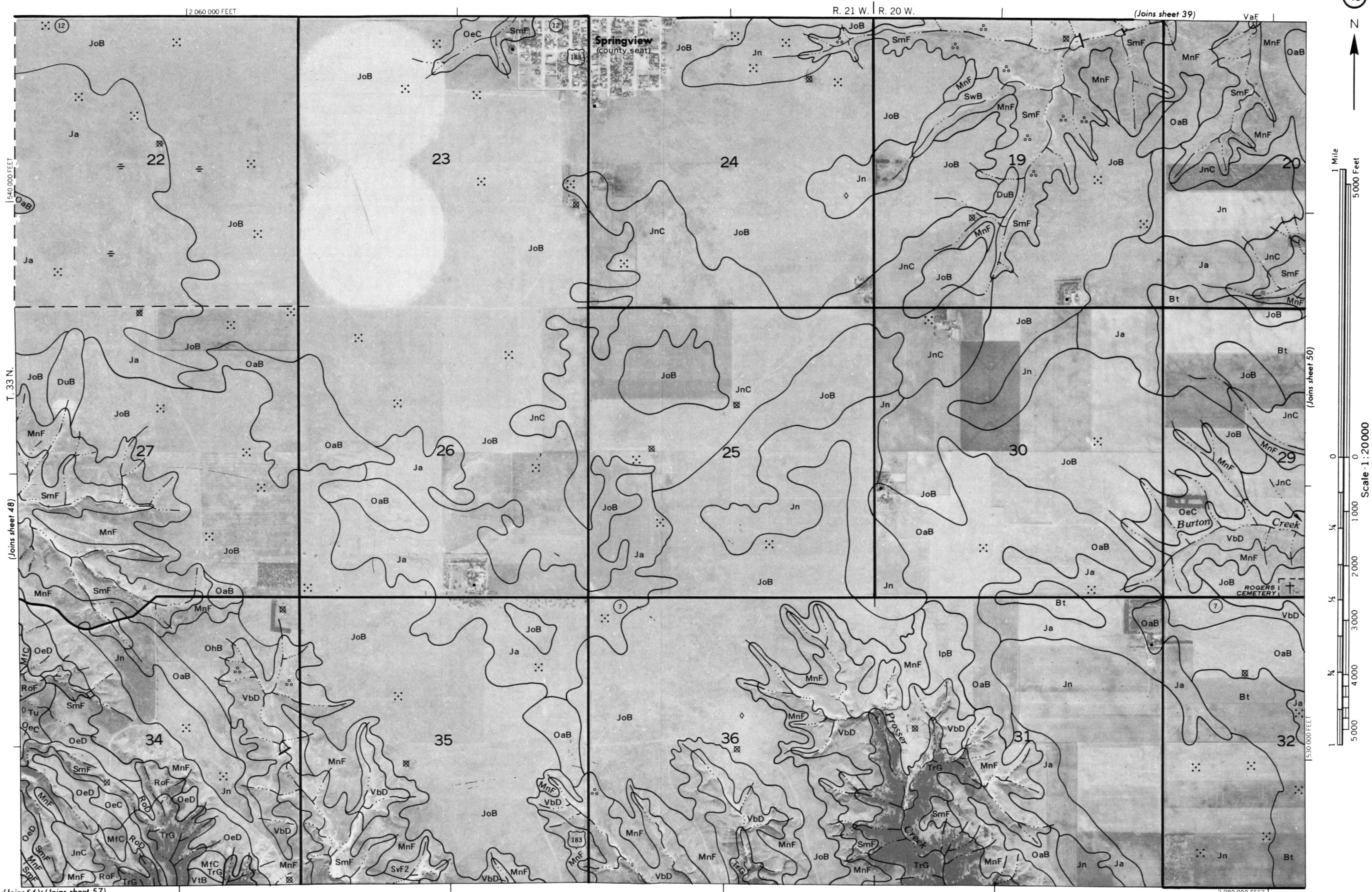


KEYA PAHA COUNTY, NEBRASKA NO. 47

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

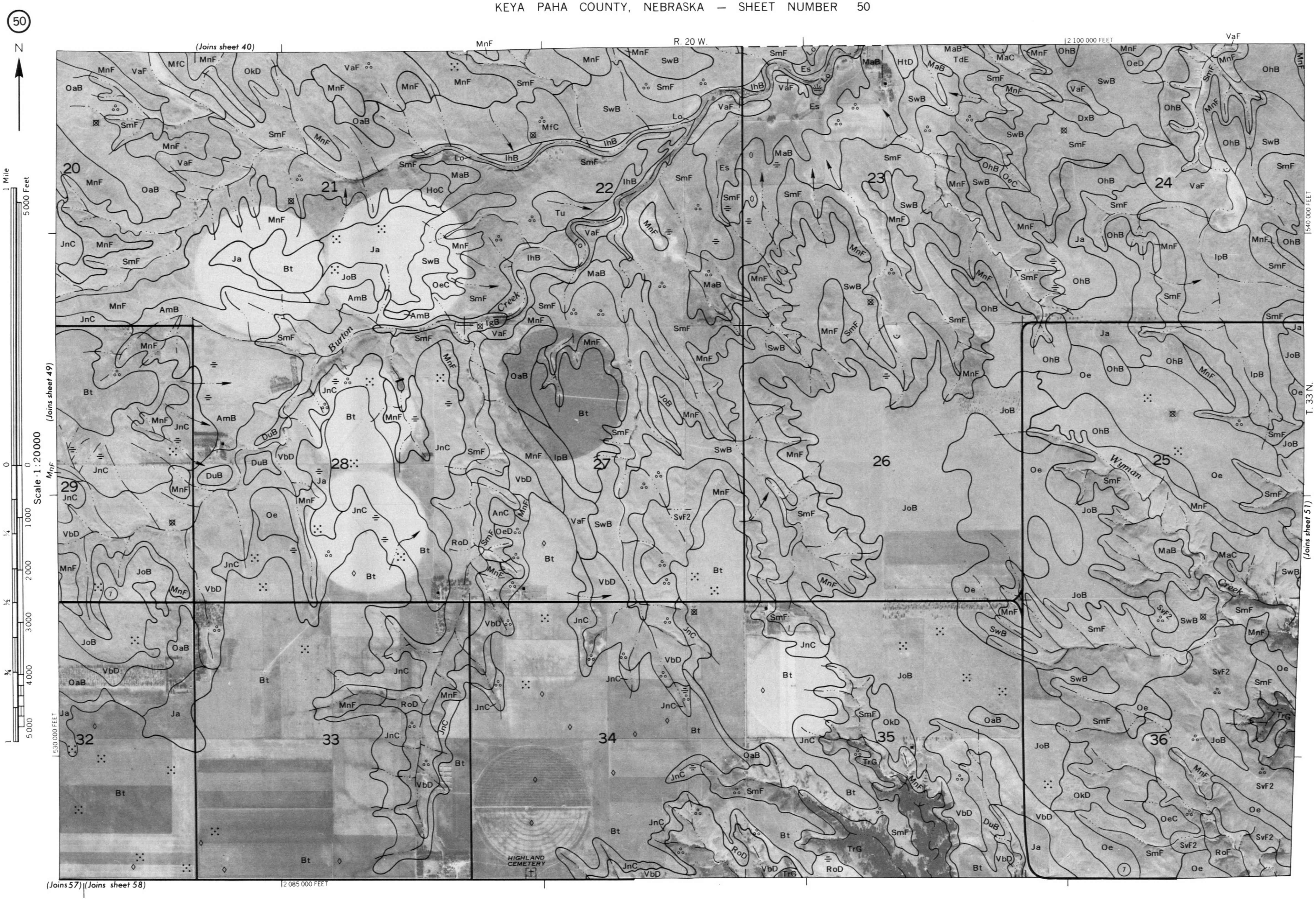


This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



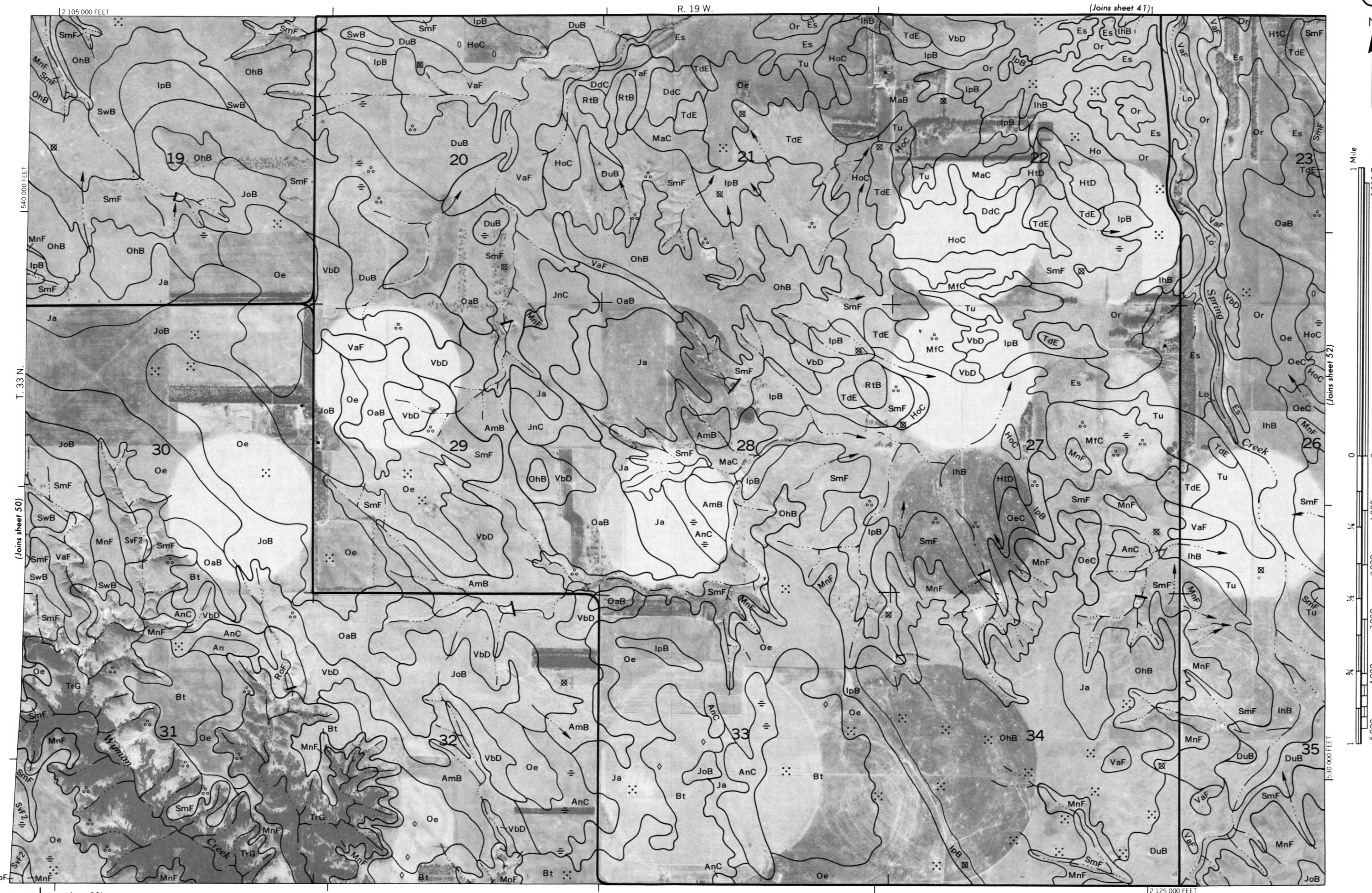
KEYA PAHA COUNTY, NEBRASKA NO. 49

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

KEYA PAHA COUNTY, NEBRASKA NO. 50

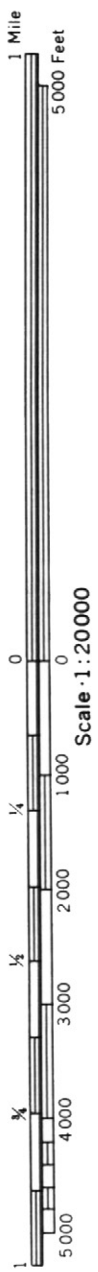


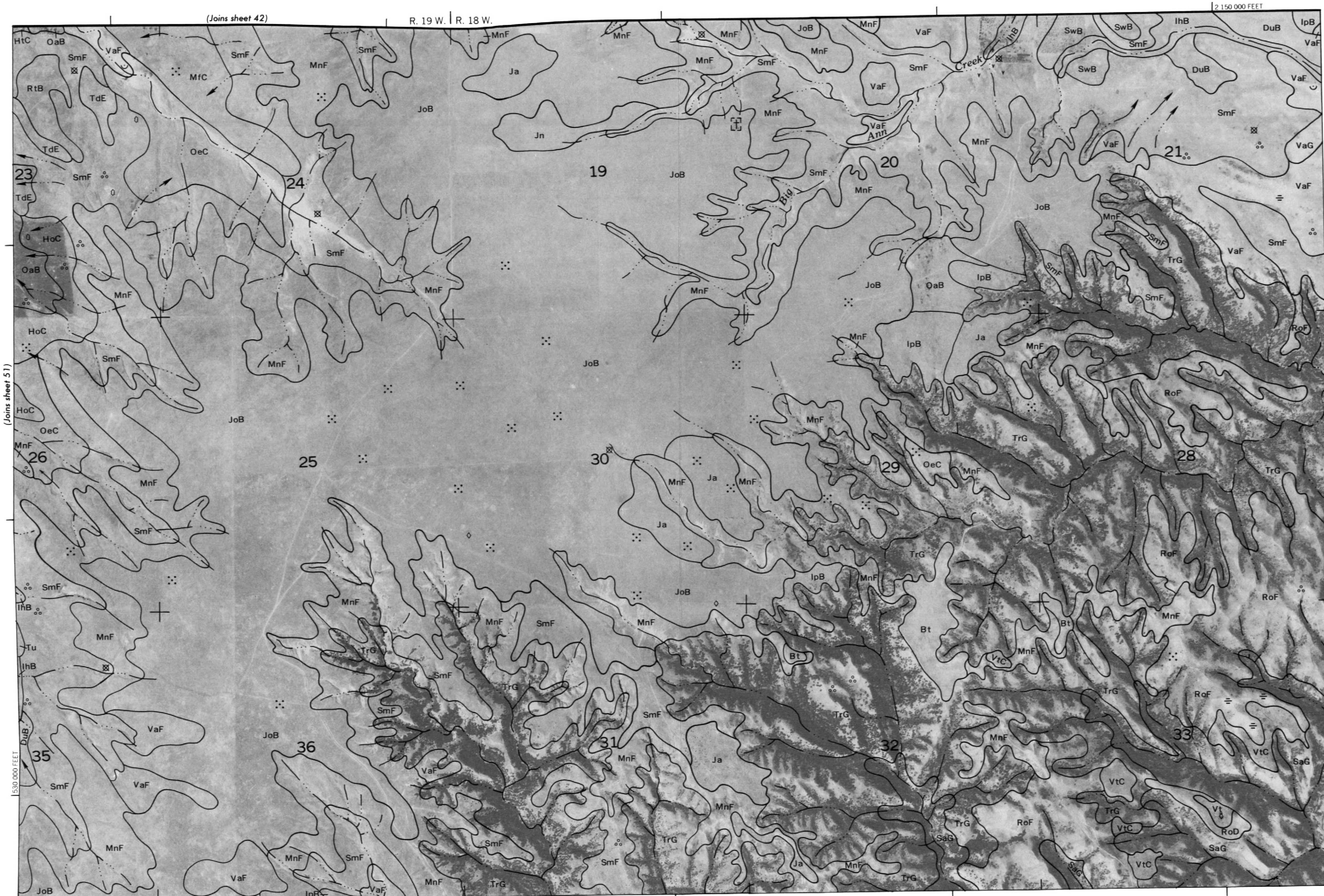
KEYA PAHA COUNTY, NEBRASKA NO. 51

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

52

N


1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1

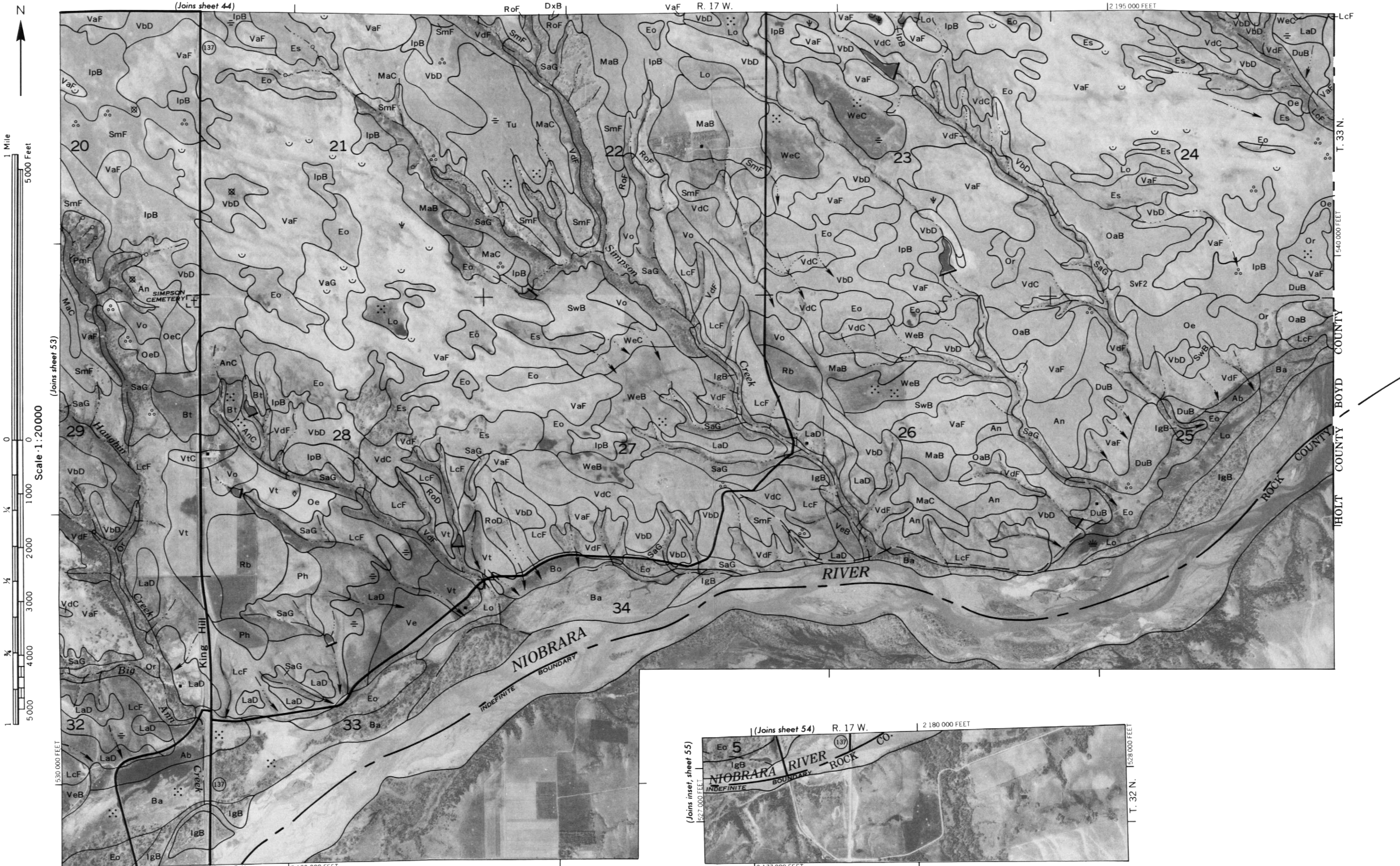

(Joins sheet 42)
R. 19 W.
R. 18 W.
2 150 000 FEET
540 000 FEET
T. 33 N.
(Joins sheet 53)
(Joins sheet 51)
530 000 FEET
(Joins59)
(Joins sheet 60)
2 130 000 FEET
Big
Ann
Creek
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36

53

KEYA PAHA COUNTY, NEBRASKA NO. 53

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

KEYA PAHA COUNTY, NEBRASKA — SHEET NUMBER 54

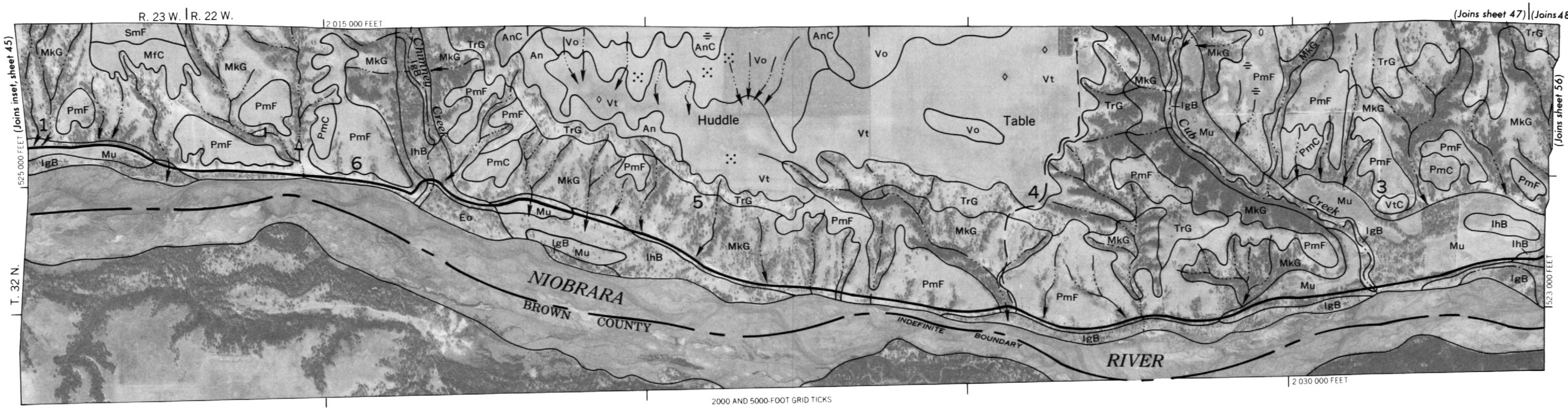


1000 AND 3000-FOOT GRID TICKS

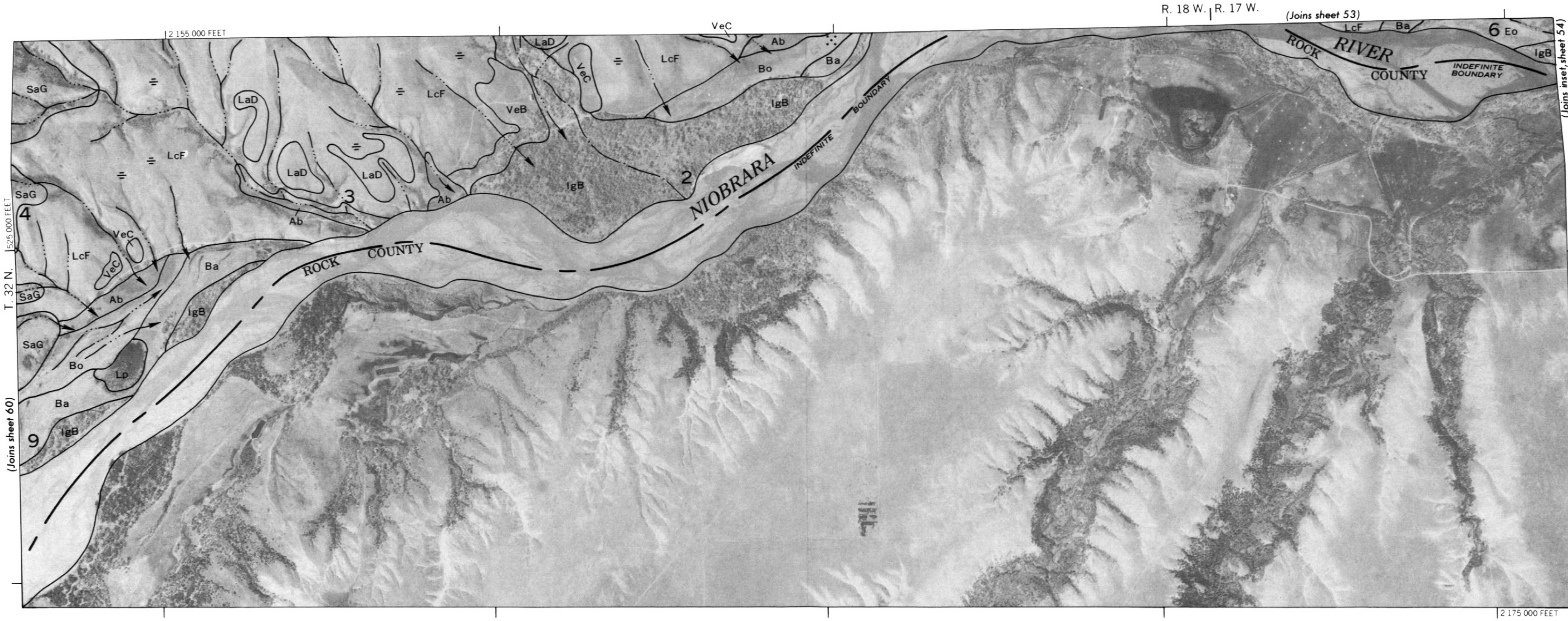
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

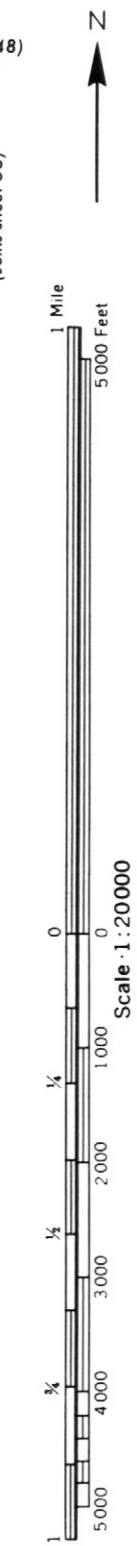
KEYA PAHA COUNTY, NEBRASKA NO. 54

55

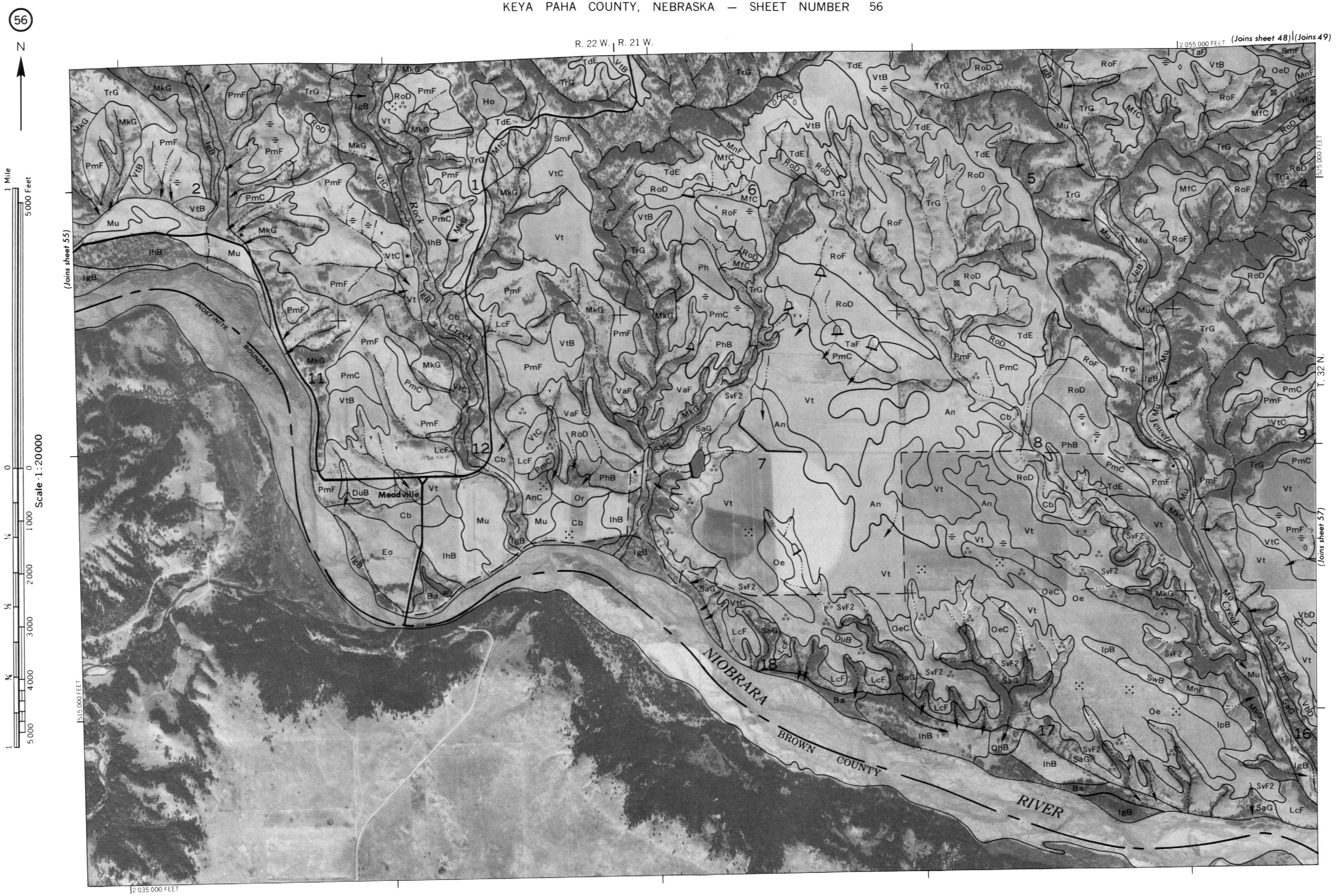


2000 AND 5000-FOOT GRID TICKS



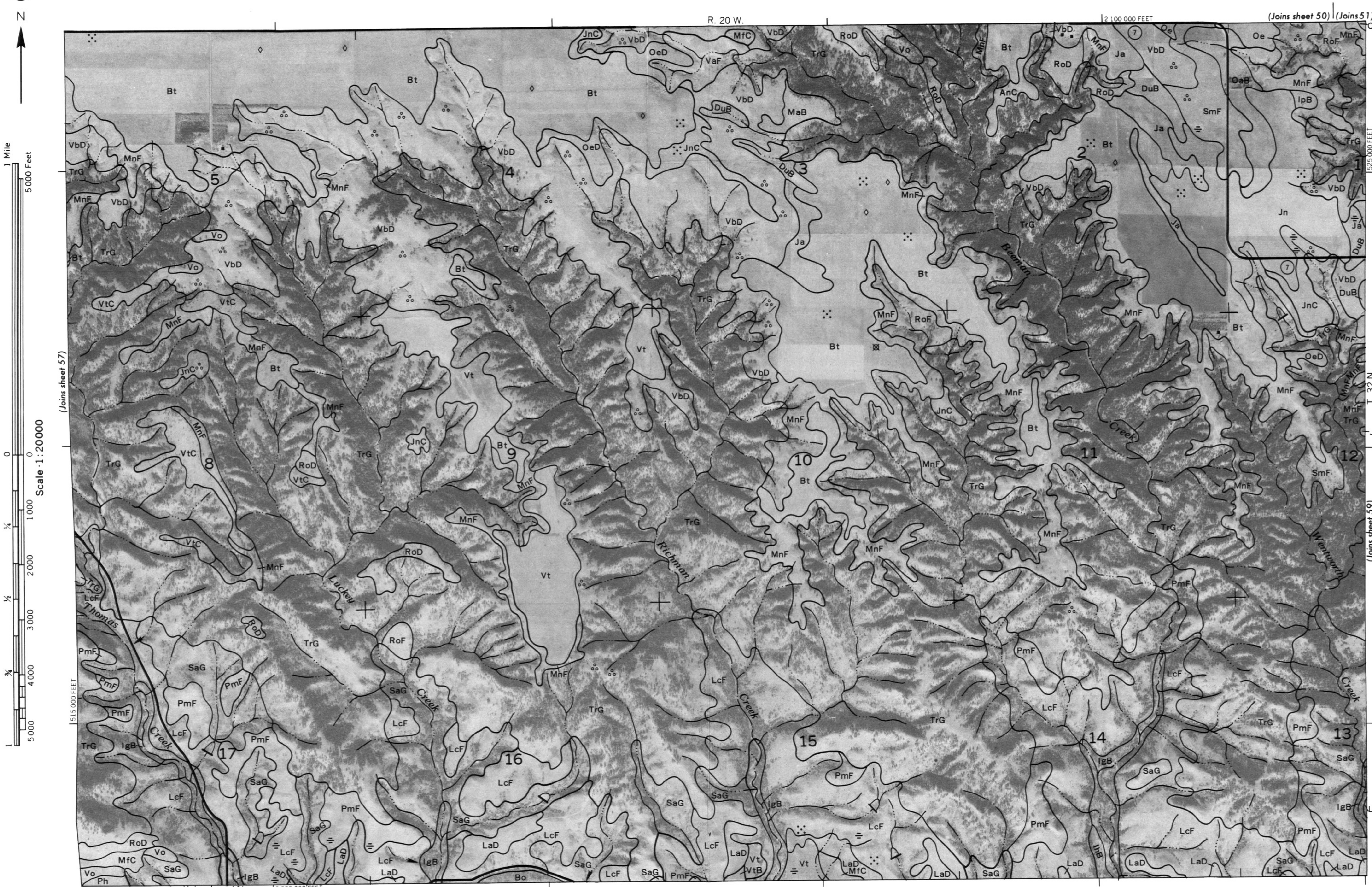


This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

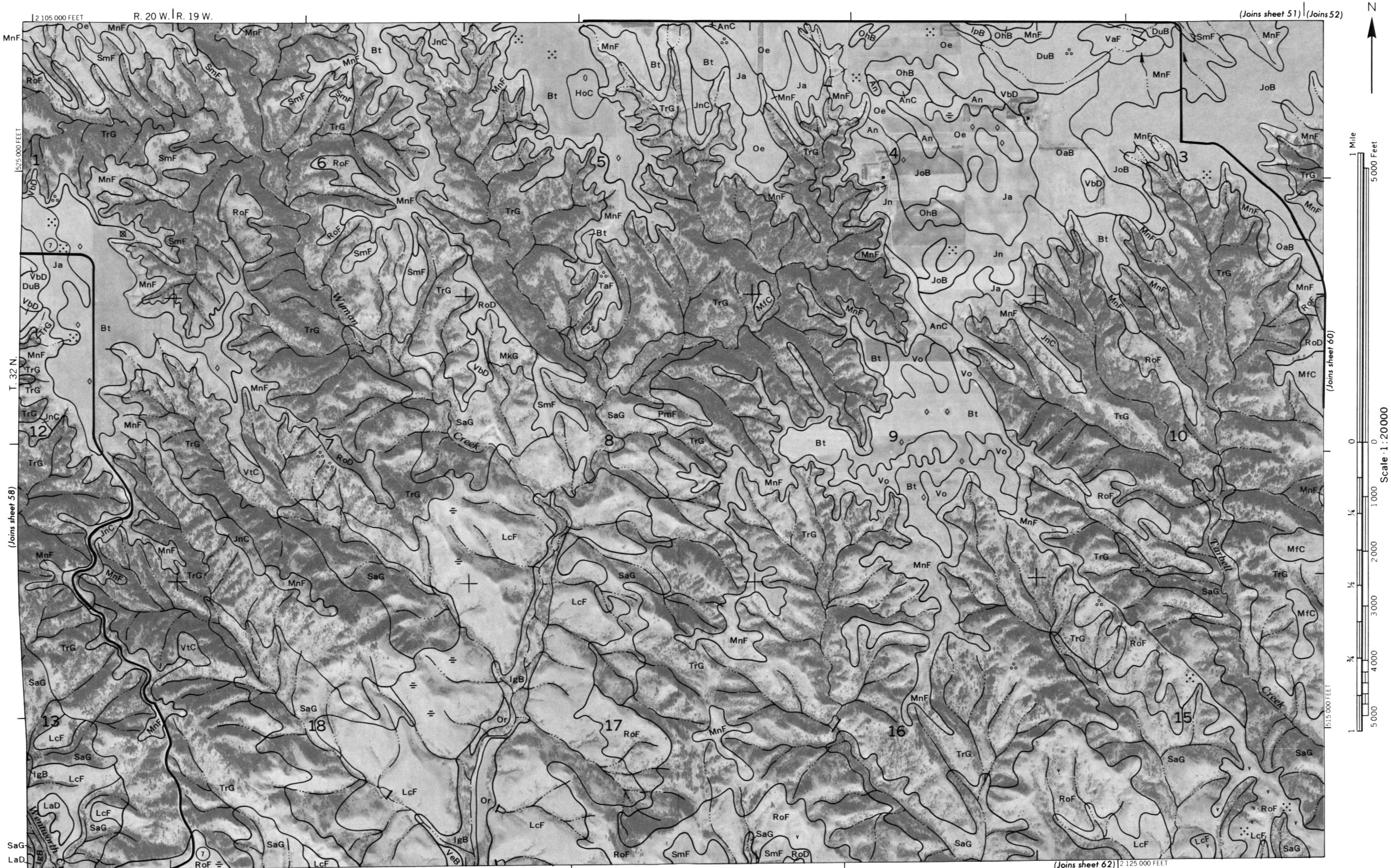


This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



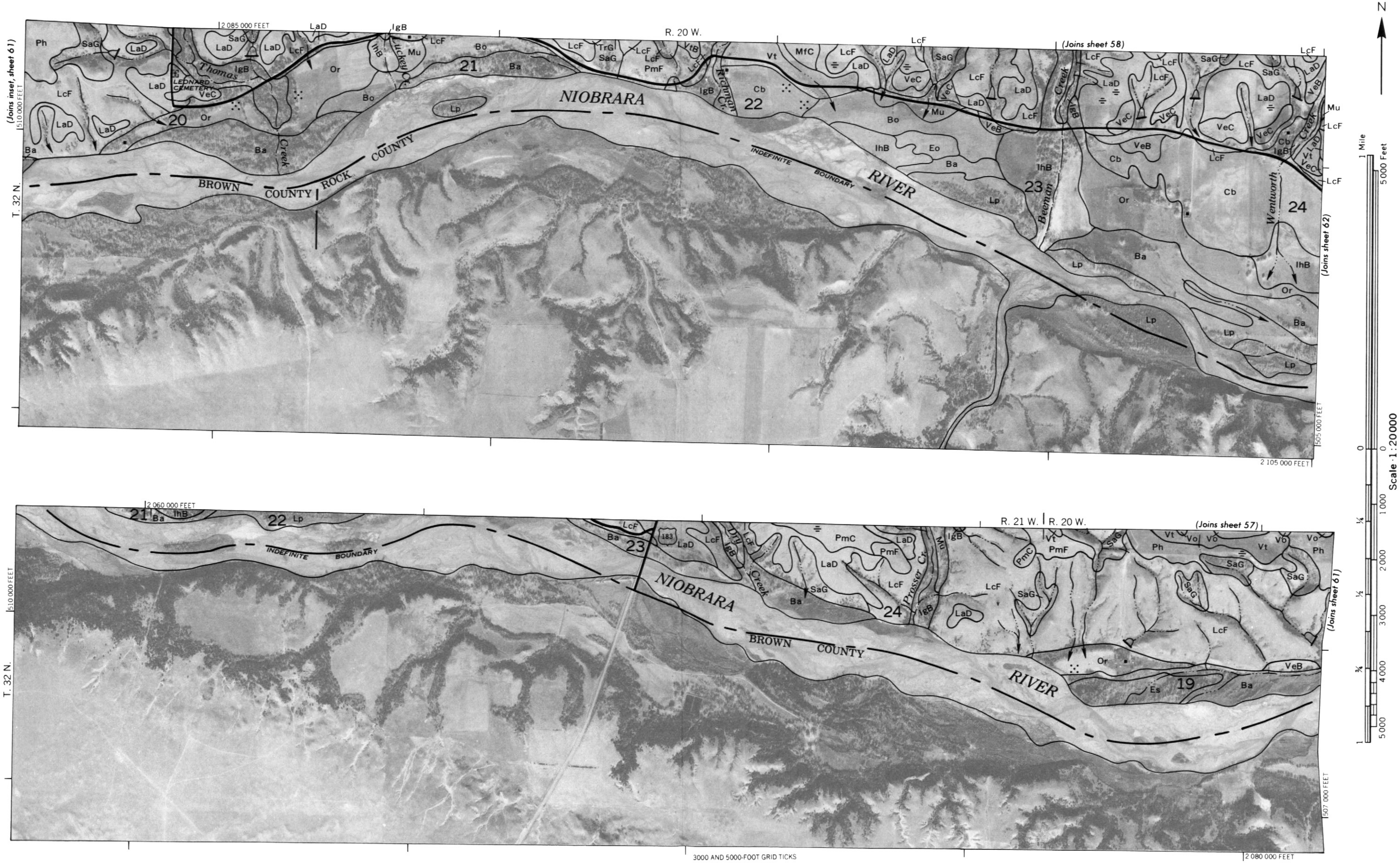
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



KEYA PAHA COUNTY, NEBRASKA NO. 59

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



KEYA PAHA COUNTY, NEBRASKA NO. 61
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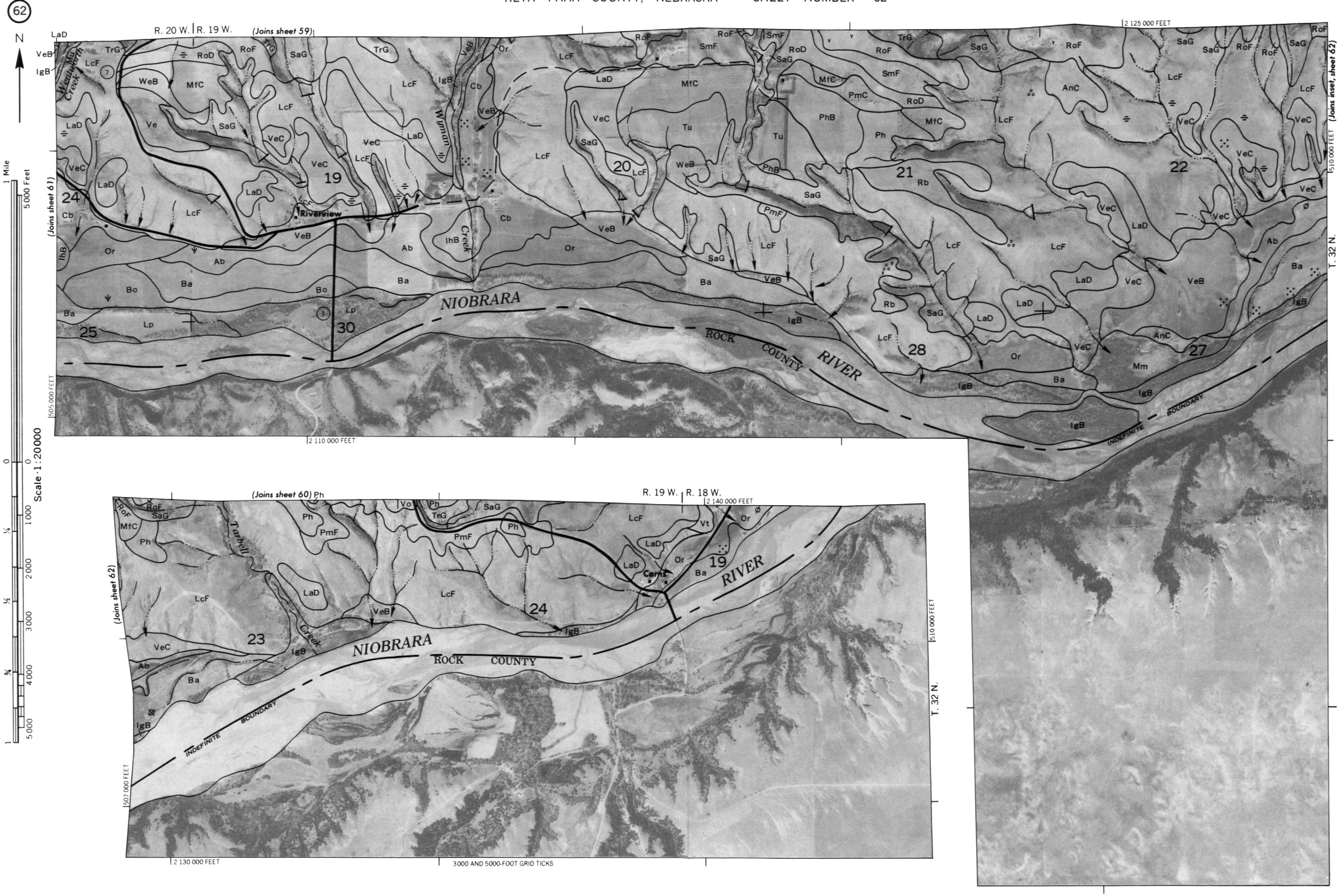

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KEYA PAHA COUNTY, NEBRASKA NO. 62